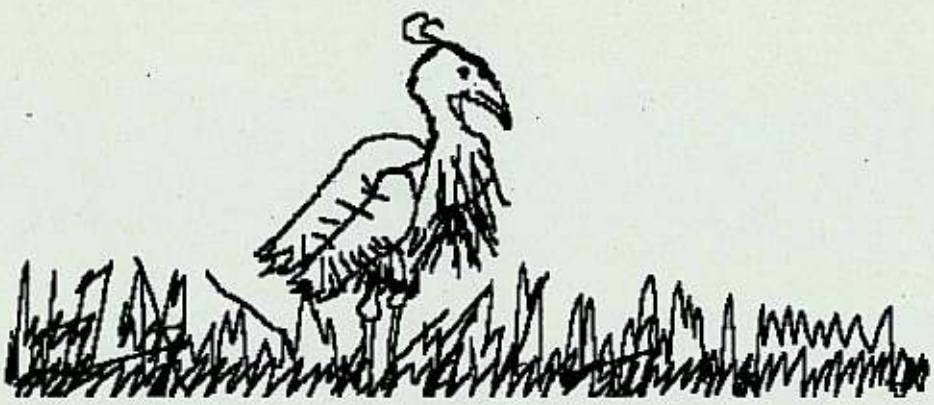
Lower Yakima Valley Wetlands and Riparian Restoration Project

Final Environmental Assessment

DOE No. 0941



Bonneville Power Administration, Yakama Indian Nation, Bureau of Indian Affairs

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CHAPTER 1: PURPOSE OF AND NEED FOR ACTION

1.1 Proposed Action

Bonneville Power Administration (BPA) proposes to fund that portion of the Washington Wildlife Mitigation Agreement pertaining to the Lower Yakima Valley Wetlands and Riparian Restoration Project (Project) in a cooperative effort with the Yakama Indian Nation and the Bureau of Indian Affairs (BIA). The proposed action would allow the sponsors to secure property and conduct wildlife management activities for the Project within the boundaries of the Yakama Indian Reservation.

This Environmental Assessment examines the potential environmental effects of acquiring and managing property for wildlife and wildlife habitat within a large 20,340 hectare (50,308 acre) project area. As individual properties are secured for the Project, three site-specific activities (habitat enhancement, operation and maintenance, and monitoring and evaluation) may be subject to further site-specific environmental review. All required Federal/Tribal coordination, permits and/or approvals would be obtained prior to ground disturbing activities.

1.2 Purpose Of and Need For Action

The proposed action is necessary to meet the underlying need for mitigation of wildlife and wildlife habitat adversely affected by the construction of Bonneville, The Dalles, John Day, and McNary Dams and their reservoirs.

The purposes of the proposed action are to:

- Increase quality and quantity of wetland, riparian, and upland wildlife and wildlife habitat on the Yakama Reservation;
- Maintain consistency with the interim Washington Wildlife Coalition Agreement;
- Maintain consistency with the Council's 1989 Fish and Wildlife Program Wildlife Rule and the 1993 Phase IV Resident Fish and Wildlife Program Amendments.

1.3 Background

1.3.1 Mitigation Process under the Northwest Power Act

Under provisions of the Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Northwest Power Act), BPA has the authority and obligation to fund wildlife mitigation activities consistent with the Northwest Power Planning Council's Fish and Wildlife Program. The initial phase of mitigation planning for wildlife habitat losses was submitted to the Council for amendment into the Fish and Wildlife Program in 1989. The Fish and Wildlife Program includes a process for review of habitat losses and design of mitigation plans for each of the Federal hydro projects in the Columbia River Basin (Section 1002).

In 1989, the Council amended the program to include wildlife habitat losses resulting from construction and operation of Bonneville, The Dalles, John Day, and McNary Dams. The Council adopted an interim goal, for a ten year period, of addressing up to 35 percent of the wildlife habitat losses due to construction of the Federal hydropower system on the Columbia River and its tributaries (Section 1003, Measure (1) (C)).

Consistent with Section 1003(7) of the Program's Wildlife Mitigation Rule, BPA proposes to fund projects that will help to reach the Council's mitigation goals. In 1990, the Council reviewed and approved the proposed Yakama Indian Nation's "Lower Yakima Valley Wetlands and Riparian Project."

1.3.2 Relationship to Other Actions

The Environmental Assessment incorporates concepts from and is consistent with the following Yakama Indian Nation resource plans:

- Yakima Indian Nation Land and Natural Resources Policy Plan (T-92-87).
- Yakima Indian Nation Wildlife Mitigation Plan (T-24-91).
- Yakima Indian Nation Waterfowl Management Plan (Meuth, 1989).
- The Integration of Cultural, Agricultural, Wildlife, and Fisheries Resources in the Toppenish Creek Corridor: A Tribal Enhancement Project (YIN, 1992).

Potential activities proposed in the Environmental Assessment are also consistent with the goals and policies of the following Federal and Regional plans, programs, and agreements:

- Washington Wildlife Mitigation Agreement -- Among Members of the Washington Wildlife Coalition of Resource Agencies and Tribes and the BPA (1993).
- Columbia River Basin Fish and Wildlife Program and Amendments (Northwest Power Council, 1982).

CHAPTER 2: ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 Introduction

This Chapter describes a No-Action Alternative (Alternative A) and a Land Acquisition and Habitat Enhancement Alternative (Alternative B). Alternative B defines the proposed land acquisition process, and presents proposed habitat enhancement, operation and maintenance (O&M), and monitoring and evaluation (M&E) activities.

2.2 No-Action: Alternative A

In Alternative A, BPA **would not fund** or reimburse activities on the Yakama Indian Reservation that are necessary to partially mitigate wildlife and wildlife habitats adversely affected by construction of Bonneville, The Dalles, John Day, and McNary Dams and their reservoirs. To protect wildlife and key wetland, riparian, and upland wildlife habitats within the Reservation project area, the Yakama Indian Nation and the BIA could pursue alternative funding sources and negotiate land management agreements with others.

Selection of Alternative A could reduce opportunities for BPA to receive credit for wildlife mitigation under the Council's Fish and Wildlife Program, and would limit the ability of BPA to meet terms and conditions of the Washington Wildlife Mitigation Agreement.

2.3 Land Acquisition and Habitat Enhancement: Alternative B

In Alternative B, BPA **would fund** activities on the Yakama Indian Reservation that are necessary to partially mitigate wildlife and wildlife habitats adversely affected by the construction of Bonneville, The Dalles, John Day, and McNary Dams and their reservoirs. BPA reimbursement would enable the Yakama Indian Nation to immediately secure Reservation lands for wildlife habitat and to enhance, maintain, and monitor site-specific conditions to increase wildlife values.

Selection of Alternative B would increase opportunities for BPA to receive credit for wildlife mitigation under the Council's Fish and Wildlife Program, and provide the means for BPA to meet the terms and conditions of the interim Washington Wildlife Mitigation Agreement. Selection of Alternative B would allow BPA to reimburse the Yakama Indian Nation for land acquisition costs, and fund long term wildlife habitat enhancement, O&M, and M&E activities; and the Bureau of Indian Affairs (BIA) to convert all fee patent properties acquired for the Project into trust status. Alternative B would allow the Yakama Indian Nation to secure approximately four parcels of high priority lands or approximately 4,047 hectares (10,000 acres) and initiate or subcontract the development of about 25,000 habitat units within the next five years.

2.3.1 Alternative B Description

2.3.1.1 *Project Area Location*

As shown in Figure 1, the project area encompasses 20,340 hectares (50,308 acres) of bottom lands along the Yakima River, Toppenish, and Satus Creek stream corridors. The project area is located in the State of Washington, and totally within the boundaries of the Yakama Indian Reservation (See Figure 2).

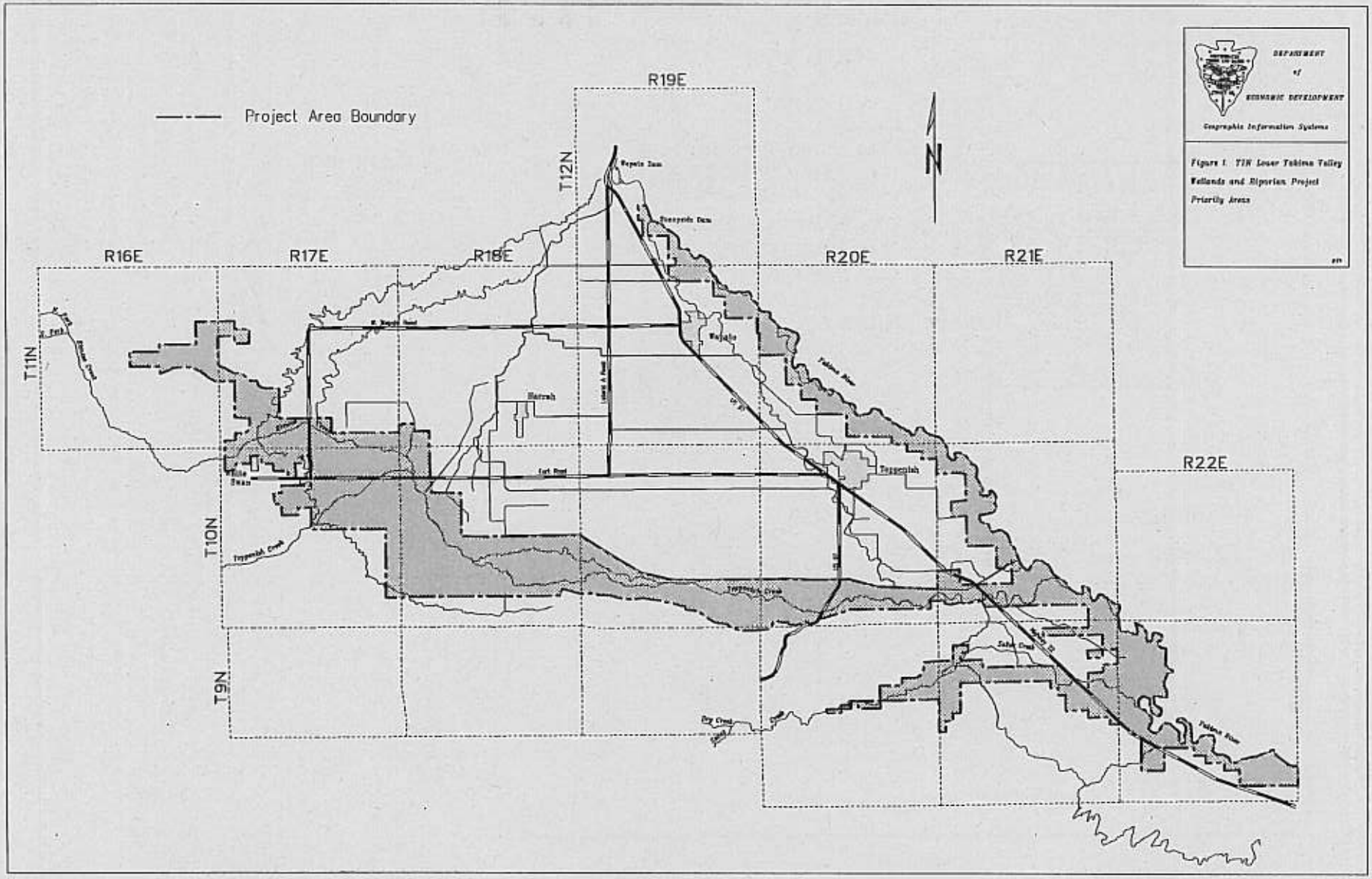
2.3.1.2 *Yakama Indian Nation Land Acquisition Guidelines*

Unless different funding arrangements between Yakama Indian Nation and the BPA are agreed on, all lands identified for inclusion into the Project would be secured with non-federal Tribal funds. The following conditions would apply to all land acquisitions within the project study area:

- The Yakama Indian Nation may acquire (through purchase, lease, or conservation easement) fee patent lands, trust lands or individual allotments and their associated water rights for the Project. Fair market values of all land parcels are established through Federal land value/lease appraisals, and secured through existing Tribal/BIA purchasing, leasing or conservation easement procedures (25 CFR 151.3).
- Large contiguous Reservation parcels and acreage highly suitable for wildlife habitat mitigation are identified and prioritized for inclusion into the Project.
- Land acquisitions for the Project are on a voluntary basis and would not involve land condemnations.
- Suitable properties not falling totally within the project area boundaries (due to property line locations, or other land use considerations) could be determined eligible for acquisition on a case by case basis.
- After purchase, a Yakama Agency BIA application shall be immediately filed to turn all fee patent properties into trust status. The BIA would notify local and county governments of such proceedings and/or transactions as established through existing BIA procedures (25 CFR 151.8 through 25 CFR 151.12).

2.3.1.3 *Yakama Indian Nation/BPA Funding and Management Agreement*

- The Yakama Indian Nation and BPA shall finalize and formally stipulate the terms and conditions for long term funding and management of the Lower Yakima Valley Wetlands and Riparian Restoration Project. A specific BPA/Yakama Indian Nation funding and management agreement shall be established for each individual property secured for the Project.
- Terms and conditions of the Yakama Indian Nation/BPA funding and management agreements shall include but are not limited to the total land protection costs and the length of agreement.


Project Area Boundary
R19E
R16E
R17E
R18E
R20E
R21E
R22E
T12N
T11N
T10N
T9N
N
DEPARTMENT
OF
ECONOMIC DEVELOPMENT
Geographic Information Systems
Figure 1. TIN Lower Tahlma Valley
Wetlands and Riparian Project
Priority Areas
Repete Dam
Pineyards Dam
Wapato
Yakima River
Toppenish
Fort Road
Toppenish Creek
Zoppa Creek
Dry Creek

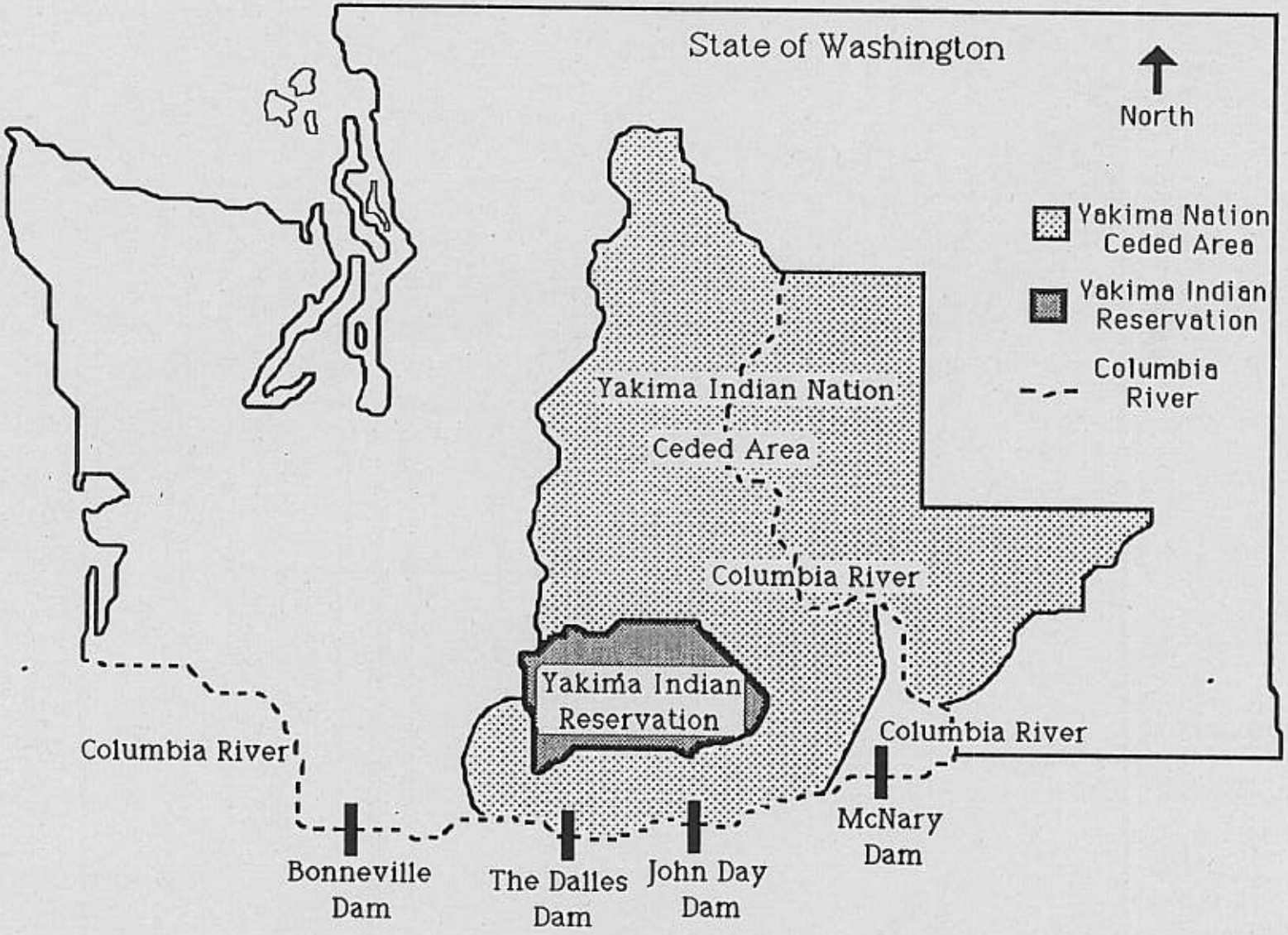


Figure 2. Map of location of Yakima Indian Reservation and Ceded Area in relation to the State of Washington and the Lower Columbia River dams.

2.3.2 Managing Acquired Land for Wildlife Habitat

2.3.2.1 *Site Planning and Enhancement*

A long term management plan (Site Plan) would be developed for each individual property acquired for the Project. The Site Plan shall document the site-specific management and enhancement activities, O&M, and M&E operations to be implemented at each property (See Sections 2.3.2.2, 2.3.2.3, and 2.3.2.4 below). Exhibits shall include but are not limited to engineering specifications of all planned habitat enhancement activities, time schedules, equipment, and personnel needs. Detailed budget information for both initial work activity and long-term management requirements should also be included.

Completed Site Plans and budgets may be subject to further National Environmental Policy Act (NEPA) review prior to implementation. This may include further coordination with BIA, appropriate Tribal programs, BPA, and other Federal agencies, to ensure consistency with Federal environmental legislation and Tribal program requirements. All site-specific NEPA analysis and decisions would be tiered to this Environmental Assessment.

2.3.2.2 *Proposed Habitat Enhancement Activities*

Proposed enhancement and restoration activities by habitat type include:

Riparian forest, shrub, and herb:

a) fencing to control domestic livestock
b) native vegetation establishment to improve habitat values
c) controlled burning and herbicide applications for weed control purposes

Agricultural:

a) wildlife food plot establishment, cultivation, and irrigation
b) edge or fence row habitat enhancement
c) fencing to control domestic livestock
d) converting pasture and cropland to wildlife habitat

Sand/gravel/cobble/ mud:

a) fencing to control domestic livestock
b) controlled burning and herbicide applications for weed control purposes

Lacustrine:

a) fencing to control domestic livestock
b) water control structure (dikes, ditches, pipes, pumps) establishment to manage water levels and control of aquatic vegetation
c) sediment removal to control eutrophication rates of ponds and sloughs
d) water source development (wells, dikes, ditches, pipes, pumps) for additional water sources
e) native vegetation establishment to improve habitat values

f) controlled burning and herbicide applications for weed control purposes
g) removal of carp

Riverine:

a) fencing to control domestic livestock
b) shoreline protection to decrease erosion potential
c) native vegetation establishment to improve habitat values

Emergent wetland:

a) land contouring (earth berms and cuts) to restore previous wetland structures
b) dike repair or construction for improved water sources
c) installation of water control devices (dikes, ditches, pipes, pumps) to manage wetland water levels
d) native vegetation establishment to improve habitat values
e) water source development (wells, ditches, pumps, pipes) to provide additional water sources

Shrub-steppe and grassland:

a) land contouring to decrease erosion potential
b) fencing to control domestic livestock
c) native vegetation establishment to improve habitat values
d) controlled burning and herbicide applications for weed control purposes
e) irrigation development to maintain replanted native vegetation

2.3.2.3 *Proposed O&M Activities*

O&M of an individual site shall continue indefinitely through annual funding from BPA. Specific activities shall be approved in individual management site plans. Proposed O&M activities for Project lands within the study area (by habitat type) include:

All habitat types:

a) fence maintenance activities
b) weed control activities
c) limit of public access through maintenance of gates, development of interpretive trails, kiosks, and hunting and photographic blinds
d) amendment and update of management plans

Riparian forest, shrub, and herb:

a) vegetation management to increase or maintain habitat values

Agricultural:

a) cultivation, planting and irrigation of croplands including food plots of corn, sorghum, millet, wheat, oats and cover plots of grass/herbaceous plant mixtures
b) management of fence row habitats

Sand/gravel/cobble/mud:

a) water level management to maintain habitat values

Lacustrine:

a) water level management to maintain habitat values
b) water source maintenance to maintain habitat values
c) water control structure maintenance to maintain habitat values

Riverine:

a) water level management to maintain habitat values

Emergent wetland:

a) dike repair to maintain habitat values
b) maintenance of water control devices to maintain habitat values
c) aquatic vegetation management by water level manipulation, controlled burning, mowing and herbicide applications to maintain habitat values
d) water level management to maintain habitat values

Shrub-steppe and grassland:

a) native grassland management by controlled burning, planting, grazing, mowing, and herbicide applications
b) irrigation of plantings to maintain habitat values

2.3.2.4 *Proposed M&E Activities*

M&E of a site will begin immediately after land is secured for the Project. Initial baseline surveys to document the land's current condition, and maps of existing vegetation and habitat types are required. Additional long term monitoring to evaluate changes in site-specific and/or overall project area conditions may include visual surveys and/or sampling of:

- Wildlife population trends and habitat use
- Wildlife habitat
- Terrestrial vegetation
- Public use
- Wetland hydrology
- Aquatic vegetation
- Macroinvertebrates
- Wetland water chemistry
- Riparian nesting cavity availability
- Riparian forest health
- Winter wildlife population trends, food plot longevity and use
- Irrigation water efficiency and conservation
- Fish habitat and populations
- Historic, prehistoric and traditional cultural use sites

CHAPTER 3: AFFECTED ENVIRONMENT

3.1 Physical Environment

3.1.1 Climate

The Yakama Indian Reservation lies largely within the rain shadow of the Cascade Mountain Range. Hot, dry summers and cold, dry winters are the general rule. In the lower Yakima Valley project area, annual precipitation averages 15.2 to 25.4 cm (6-10 inches). Roughly 5 percent of the total .76 to 1.3 cm (.3 to .5 of an inch) is received as rain during August and September. Summer average daily maximum temperature is 29^0 C (85^0 F). Winters are typically cold and dry with an average daily minimum temperature of -13^0 C (25^0 F). About 50 percent of the annual precipitation falls during winter months as snow (October-January).

3.1.2 Geology

Geology of the larger Yakima River Basin is characterized by a series of long north, south facing ridges that extend eastward from the crest of the Cascade mountains. The dominant structural feature in the Yakama Indian Reservation interior is the east-west Toppenish uplift. Beginning at the Klickitat River, this uplift plunges eastward from an elevation of 1524 to 457 meters (5,000 to 1,500 feet) near the Yakima River, 81 kilometers (50 miles) distant. The Toppenish uplift bisects the Reservation, creating north and south portions. Between the Toppenish and Ahtanum uplifts lies the Toppenish structural basin. This 16 to 23 kilometer (10-14 mile) wide basin begins near the Klickitat River at an elevation of 1372 meters (4,500 feet), and stretches 64 kilometers (40 miles) east to the Yakima River at an elevation of 274 meters (900 feet). The eastern portion of this Basin includes the project area.

3.1.3 Soils

The majority of the project area falls within two general soil associations. These are the Toppenish-Umapine association and the Weirman association. The Toppenish-Umapine association is characterized as deep, somewhat poorly drained, medium to moderately fine textured soils formed in alluvial deposits. Because of the drainage characteristics of these soil types, they are typically saline in nature and range from mildly to very strongly alkaline. Irrigation and drainage for agricultural purposes has increased leaching and removal of salts in much of the project area. This association is primarily found along Toppenish and Satus Creeks and extends north in a broad band beyond the City of Toppenish. The Weirman association is characterized as deep, well to excessively drained, medium to moderately coarse textured soils formed in recent to old alluvium. These soils are commonly underlain by very gravely material. This association is primarily found in a narrow band of about 800 meters (1/2 mile) in width along the Yakima River from Union Gap to Mabton. The Weirman association's widest extent 3.2 to 4.8 kilometers(2 to 3 miles) occurs in the Wapato vicinity (Berkompas, 1994).

Currently, there are ten to fifteen soil types in the Reservation that are designated as unique and prime farmland when or if they are irrigated (SCS, 1990). Using current Yakama Indian Nation GIS data, it was estimated that approximately 7,285 hectares (18,000 acres) of these highly productive soil types are located within the project area, and that roughly 809 hectares (2000 acres) of these soil types are irrigated.

3.1.4 Air Quality

For the past several years, the State of Washington has designated portions of the Yakima County area, as an air quality non-attainment area for particulate less than 10 microns diameter (PM-10), and carbon monoxide levels. These pollutants are emitted as the result of outdoor burning of vegetation. Enforcement of the State permitting regulations for open burning of agricultural, silvicultural, and other vegetative refuse is delegated to the local Yakima Clean Air Authority. A review of Yakima Clean Air Authority maps (1994) indicate the Yakama Indian Reservation project area is presently outside of the area of concern when following local Fire District and Clean Air Authority permitting procedures (Svenendsen, 1994).

3.2 Water

3.2.1 Floodplains/Wetlands

The floodplains of the Yakima River were mapped by the U.S. Army Corps of Engineers (1975). The Toppenish Creek (and vicinity) floodplains were mapped by personnel of BIA Land Operations. A review of these maps indicates that 80-90 percent of the project area is currently within the floodplains of the Yakima River, Toppenish or Satus Creeks.

Approximately 3 percent of the project area [626.5 hectares (1,548 acres)] is currently classified as emergent wetland.

3.2.2 Water Quantity

The Yakima River and three of its tributaries (Ahtanum, Toppenish and Satus Creeks) drain the eastern portion of the Yakama Indian Reservation.

USGS Water Resource Data (1992) statistics report Yakima River annual flows at the Mabton gauge (RM 59.8) of 1,974.4 million cubic meters (1.6 million acre feet) in 1992 dry water year conditions and 2,838.2 million cubic meters (2.3 million acre feet) in 1990, a more normal water year. For the period of record (October 1970 to current year) a maximum discharge of 1053.5 m^3/second (37,200 cfs) occurred in January, 1974, and a minimum flow of 9.1 m^3/second (320 cfs) was recorded in March of 1977. Within the project area, the Wapato Irrigation Project (WIP) presently diverts about 740,400,000 m^3 (600,000 acre feet) annually from the Yakima River to the Reservation at Wapato Dam (RM 106.6). The Sunnyside Irrigation Project (immediately downstream) diverts additional Yakima River water for the Sunnyside Irrigation District. Due to the present high rate of irrigation diversions and low summer streamflows, the Yakima River typically

carries little streamflow below Sunnyside Dam during the irrigation season (April-October).

Satus Creek, Toppenish Creek, and Marion Drain contribute spring runoff and WIP return flows to the river below Sunnyside Dam at RM 82.6, 80.4, and 69.6 respectively. Satus and Toppenish Creeks originate at lower elevations than the Yakima River mainstem, and some distance east of the Cascade Crest. Normally, minimum flows for these streams occur in August and September and peak flows in January and February. The highest recorded discharges are the result of winter rain-on-snow events. Summer thunderstorms have also caused isolated flash flooding problems.

Satus Creek becomes a meandering stream as it enters the Yakima River floodplain. The WIP presently diverts runoff from the irrigated Toppenish Creek Basin into the lower Satus Creek Basin. Like lower Toppenish Creek, the lower Satus Creek reach is augmented by both surface and subsurface irrigation return flows, out of phase with the natural hydrograph. Lower Satus Creek is not diverted for irrigation purposes only because it is at lowest elevations of the WIP.

Toppenish Creek also receives irrigation return flows. Most of the return flow to Toppenish Creek comes from surface water drains, resulting in greater sediment concentration during the irrigation season. Toppenish Creek is used by the WIP to convey return flow from the western bench portion along Toppenish Ridge and the Satus area. As a result of the irrigation return flows and diversions, the summer streamflows of Toppenish Creek can vary from .6 m^3/second (20 cfs) to over 3.4 m^3/second (120 cfs) in the project area.

Marion Drain presently serves as the primary WIP drain ditch in the project area. Marion Drain collects irrigation return flows from nearly all irrigated farm lands east of the Main canal, west of Wanity Slough, and north of Toppenish Creek. The Marion Drain flows nearly 32.2 kilometers (20 miles) from the end of Harrah Drain (south of Harrah) to the Yakima River. There is only one diversion of Marion Drain, located at mile 1.7. This diversion helps feed the Satus canal system via the Toppenish Creek feeder canal diversion along State Highway 22.

The discharge of Marion Drain during the irrigation season reaches about 11.3 m^3/second (400 cfs) between its confluence with Wanity Slough and the Satus Canal diversion. Much of this flow is due to the groundwater drainage from irrigated areas on the WIP. Summer water temperatures are typically lower than in nearby Toppenish Creek. Most of the surface water input and some of the groundwater influx disappear in the late fall and winter, when fall Chinook are present.

3.2.3 Water Quality

Water quality degradation in the Yakima River from agricultural reuse of water is among the highest of all monitored streams in the State of Washington (USGS, 1992). Water quality degradation occurs annually in the lower 40 percent of the river, roughly from Sunnyside Dam downstream to the mouth of the Yakima River (BPA, 1992). This is

due to the amount of irrigation diversions and lack of streamflow especially in dry years, and the irrigation return flows that contribute heavy suspended sediment load and nutrients to the Yakima River. Existing conditions for the Yakima River and tributaries have been documented in ongoing monitoring studies by the State of Washington and the U.S.Geological Survey.

The Washington Department of Ecology defines the water quality conditions that affect both aquatic life and human health for all surface waters in the State of Washington. The parameters vary depending on how individual water bodies are classified. Currently, the Yakima River and tributaries within the project area are designated as Class A streams. During the summer irrigation season, the Class A water quality parameters for temperature, pH, dissolved oxygen, fecal coliform, turbidity, nutrients, and toxicants have been exceeded as irrigation diversion and return flows enter the Yakima River. State, Federal, and Tribal water quality programs are currently in place to address Yakima Basin water quality issues. Tribal water quality standards are currently under development for the streams within the project area and vicinity.

3.3 Biological Resources

3.3.1 Wildlife

Prior to the introduction of domestic livestock, European settlers, and irrigated agriculture, native wildlife from the Toppenish Creek basin and the Yakima River valley was a main source of sustenance and raw material for the Yakama Nation Tribes and Bands. The original topography of the Toppenish Creek and adjacent Yakima River floodplains supported a vast array of natural habitats which in turn provided a wide diversity of species.

An influx of non-Indian settlers to the Reservation area occurred in the late 1800s. Non-Indian settlement was facilitated by passage of the Allotment Act of 1887, which allowed the transfer of various Indian-owned lands to non-Indian ownership. Land use practices in many areas of the Reservation began the rapid transition towards the mono-culture farming and ranching practices of today. As a result vast areas of natural wetlands and uplands were drained and leveled, and many populations of resident and migratory wildlife species declined or were displaced.

The Yakima River corridor contains abundant riparian forest habitats. With the exception of cattle grazing, the corridor has remained relatively undisturbed, an uncommon condition for most river corridors in eastern Washington. Project area riparian habitats are associated with the backwaters, sloughs, and oxbows, as well as the main river channel. The riparian forest cottonwood stands support a number of species, the most noticeable being large nesting colonies of great blue herons, black-crowned night-herons, and Canada geese. The area hosts breeding mallards, wood ducks, gadwall, blue-winged teal, cinnamon teal, shovelers, redheads, and western Canada geese; a variety of shorebirds such as long-billed curlews and spotted sandpipers; raptors including northern harriers, red-tailed hawks, kestrels, short-eared owls, and prairie falcons; furbearers such

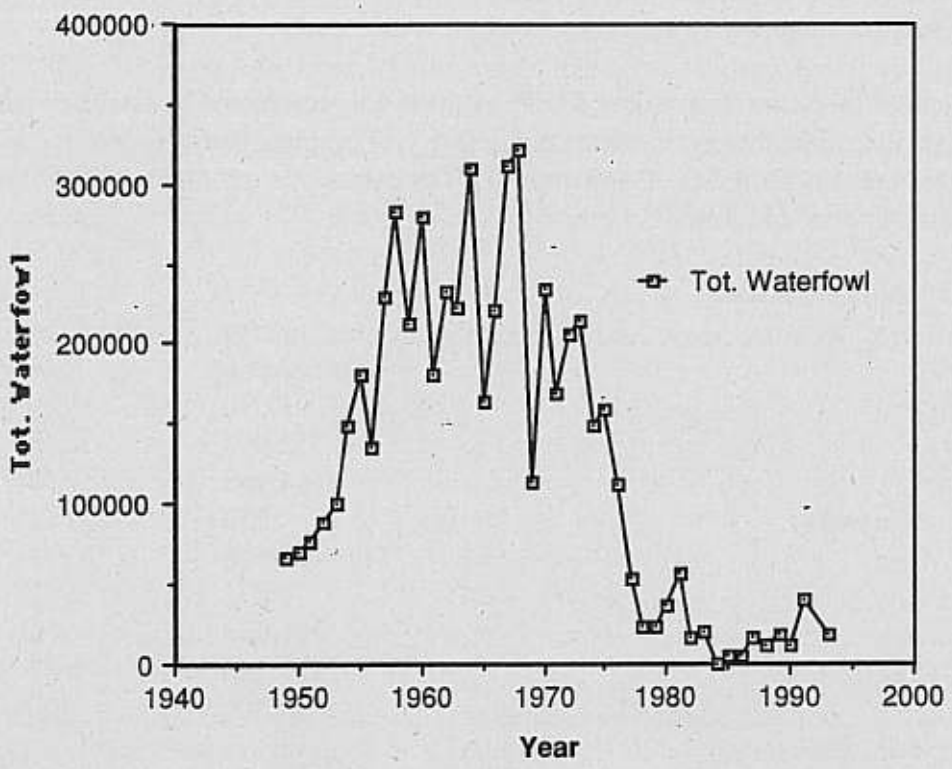
as coyotes, mink, beaver and river otter; and many species of riparian- and wetland-dependent songbirds. See Appendix B for detailed project area species list.

Toppenish and Satus Creeks, with their low gradient, braided channels, and abundant sloughs and wetlands, provide excellent wintering habitats for wildlife. The spring freshet immerses large acreage's of pasture land next to the creeks. These flooded areas are heavily used by migratory waterfowl, annually attracting 20,000 to 40,000 of the Taverner's subspecies of Canada geese en route to nesting grounds on the North Slope of Alaska. Stream banks and nearby wetlands provide wintering habitats for upland game bird and waterfowl use. Refuges along Toppenish Creek provide important sanctuaries, especially for migratory and wintering waterfowl. Riparian habitats are nearly non-existent along Toppenish and Satus Creeks due to draining and excessive livestock grazing.

Although current land use practices limit this type of habitat, residual vegetation remaining through the winter is necessary to provide critical early spring nesting cover for many species. Spring burning of rights-of-way and canal banks in the project area is followed by herbicide applications through the summer. Late spring burning within the project area has decreased active waterfowl and pheasant nesting (Oakerman 1979, Oliver 1983). Much of the area's duck production is confined to the canals and drains of the Wapato Irrigation District. The exception is those areas of undisturbed wetland habitat within the project area where per-acre waterfowl production can greatly exceed that found elsewhere. Vegetation overhanging water channels provides valuable escape and feeding cover for waterfowl broods. Today much of this type of vegetation has been removed to improve flows, eliminating many miles of channels and creeks from use by waterfowl broods. California quail and many perching birds also avoid habitats with no permanent cover.

Game bird species originally flourished with the expansion of cropland in the 1930s and 1940s and Toppenish Creek wintered up to 300,000 ducks and geese each year. As agricultural development intensified in the 1960s and 1970s, however, breeding and wintering populations of ducks, pheasants, quail, chukar, and doves rapidly declined. Wintering duck concentrations presently peak at 40,000 -50,000, although Canada goose populations have been increasing (Oliver 1983).

Figure 3.1: Yakima County Midwinter Waterfowl Counts 1948-1993.



3.3.2 Threatened and Endangered Species

Federally listed bald eagles presently use riparian forest habitat for perching sites during winter. Ospreys, and Swainson's hawks (a Washington Proposed Sensitive Species) nest in the same sites during the spring and summer months. The riparian forest, shrub, and herb habitat types are essential for many non-game birds including the Lewis' woodpecker (another Washington Proposed Sensitive Species). See Appendix A for endangered and threatened species found in the project area.

3.3.3 Vegetation (Wildlife Habitat)

Historically, large sagebrush and bunchgrass communities existed throughout the project upland areas. These plant communities were most commonly established on the north facing slopes or adjacent to intermittent streams (Smith et al. 1958:11). Along the major river courses, riparian vegetation consisted of willow, cottonwood, hawthorn, wild rose and chokecherry (Rassmussen 1976:21, 23). Many of the riparian species still exist, but are generally restricted to the water's edge. On saline and alkaline soils, greasewood and salt grasses were once the principal native species, with giant wild rye dominating low-lying, slightly saline soils. According to Smith et al. (1958:11), giant wild rye also covered much of the non-saline bottom land at the time of European settlement. Native vegetation is presently limited to a few undeveloped areas that are unsuitable for agricultural practices.

Today, the 20,340 hectare (50,308 acre) project area contains large contiguous aquatic, riparian, and upland vegetative cover types suitable for wildlife habitat. Large open space areas such as those which have been identified for the project are rapidly becoming a limited commodity in all areas of eastern Washington.

A Habitat Evaluation Procedures (HEP) analysis was conducted to establish the existing habitat conditions that are summarized below. A complete discussion of the HEP procedures and results is provided in Appendix B. The extent of each of the vegetative cover types is summarized in Table 3.1.

Table 3.1: Cover Type Extent

Cover type	Acres	% of Total
Riparian forest	2,064	4
Riparian shrub	3,096	6
Riparian herb	3,096	6
Agricultural	14,963	30
Sand/gravel/cobble/mud	258	1
Lacustrine	516	1
Riverine	1,032	2
Emergent wetland	1,548	3
Shrub-steppe/grassland	23,735	47
TOTAL	50,308	100

Source: Bich et al., 1991.

Riparian forest: occurs near ponds, lakes, or streams, and is characterized by trees such as black cottonwood. Riparian forest, approximately 4 percent of the project area, provides a common boundary along the Yakima River corridor between upland and aquatic ecosystems. The riparian forest cover type provides extremely valuable canopy cover and foraging habitat to a variety of wildlife species.

Riparian shrub: occurs on relatively moist sites and is characterized by deciduous shrubs including wild rose, willow, chokecherry and sumac. This cover type provides a narrow edge community between aquatic and upland plant communities and is extremely valuable to wildlife, providing shelter, hiding cover, fruits and berries. Riparian shrubs additionally increase channel roughness to better moderate flood flows, and provide shade to help moderate stream temperatures. Shrub root systems stabilize stream banks and create overhangs which are useful for fish cover. The higher quality riparian shrub cover (about 6 percent of the Project area total) is found in a narrow band along the Toppenish Creek and Yakima River corridors.

Riparian herb: occurs on relatively moist sites, often in close proximity to standing water. This cover type (6 percent of the project area total) is typically dominated by a variety of grasses and sedges. Plants associated with these moist sites do not dry as rapidly, have longer growing periods, and are more succulent than plants found in upland sites. These riparian sites typically are important foraging areas for wildlife species such as waterfowl, shorebirds, and aquatic mammals.

The riparian cover types, though not in ideal condition today, have the potential to provide increased wildlife habitat quality when protected. The existing riparian habitats support large and diverse wildlife populations today, because they offer the best quality and least disturbed habitat currently available in the heavily dominated agricultural setting. Most mule deer living at lower elevations near the open farmlands and urban and rural housing areas use the wooded riparian corridors for escape cover. Prevalent great blue herons, wood ducks, California quail, and Canada geese populations are found nesting within the project area riparian corridors. The riparian habitat types are also important for song and perching birds including warblers, chickadees and woodpeckers.

Agricultural: cover types are characterized by production of crops such as corn, wheat, alfalfa and mint. Croplands (roughly 30 percent of the project area) are modified annually by intensive cultivation and irrigation practices. Habitat quality in this cover type is limited due to the large seasonal variations in vegetative structure as crops are cultivated.

Though croplands in the project area once provided edge cover and winter food resources for small mammals, songbirds, and game birds, intensive farming practices such as fence row removal, fall disking and plowing, and irrigation upgrading over the past 20 years have decreased these populations. The increase in development and conversion of land from highly suitable wildlife habitat (such as emergent wetlands), to agriculture has further decreased native wildlife populations.

Sand/gravel/cobble/mud: cover types occur adjacent to riverine and lacustrine systems. These shoreline cover types (less than 1 percent of the project area) are characterized by fine to coarse substrates that typically are sparsely vegetated. These sites are most often used for shorebird foraging and nesting and waterfowl loafing. Riverine gravel bars exposed in summer may be used by spawning steelhead during higher stream stages in spring. Spawning sites occur mostly along the Yakima River and to a limited extent along Toppenish Creek.

Lacustrine and riverine: cover types are characterized not by the presence of specific plant communities, but rather by the type of water body. Together these cover types represent about 3 percent of the project area. If water flow is not evident, i.e., in lakes and ponds, the system is considered lacustrine. Conversely, if the water flows, i.e., in streams, rivers, irrigation canals, and drains, the system is classified as riverine. Although these cover types are identified only by their aquatic characteristics, several species' HEP models considered adjacent plant community features.

The lacustrine and sand/gravel/cobble/mud habitat types occur mostly as oxbow sloughs and associated shorelines along the Yakima River corridor. Artificially accelerated eutrophication caused by past and present farming and grazing practices have decreased many of the habitat characteristics necessary for waterfowl production. Infestations of water lily and common carp have precluded a wide degree of wildlife use of these aquatic systems.

Emergent wetland: cover type occurs on hydric soils and is characterized by emergent and aquatic plant species such as cattail, bulrush, wild iris, water lily, and pondweed.

Emergent wetlands (3 percent of the project area) provide extremely valuable wildlife habitat conditions for waterfowl pairing and brood-rearing cover.

Most wetland habitat in the project area has been removed through draining and land leveling. The remaining 607 hectares (about 1,500 acres) is heavily grazed during the spring and summer months, further decreasing its potential as wildlife habitat. With basic protection and enhancement activities there is excellent potential for increasing the quality of furbearer, songbird nesting and waterfowl brood rearing habitat.

Shrub-steppe/grassland: cover types are an aggregate of native and idle field upland plant communities, which provide the most widespread habitat acreage (47.2 percent) in the project area. These uplands locations are identified by native big sagebrush/bluebunch wheatgrass associations, and as idle croplands or livestock grazing pastures.

Presently, the majority of this vegetative cover type is used for intensive cattle grazing activities. Current upland conditions are poor and essentially unsuitable for habitat by native wildlife other than Canada geese. The small amount of acreage which is not presently grazed has been disturbed in the past and contains mostly exotic weed species. The introduced plant species do not provide the hiding cover necessary for successful waterfowl or upland bird nesting. The species utilizing these areas are subject to nest failure due to increased weather exposure and predation. Revegetation and protection is the only means possible to return the native vegetation characteristics to this once abundant cover type.

3.3.4 Fisheries

Fish species from five families reside in or migrate through the project area streams and ponds. A large number of minnows, suckers, sunfish, sculpins and resident and anadromous salmonids including spring and fall chinook salmon, coho salmon, steelhead and rainbow trout are present. The Yakima River provides critical winter rearing habitat for spring chinook salmon in this area, and has supported year-round juvenile salmon and steelhead in the past.

Resident and anadromous salmonids are also native to Toppenish and Satus Creeks, although habitat conditions suitable for production of salmonid fish have become confined to upstream reaches. Brook trout are presently found in the headwaters of several streams in the Satus Creek system, and cutthroat trout have a limited distribution in the upper Toppenish Creek system. Steelhead trout are distributed throughout most of the Satus Creek and Toppenish Creek drainage's. The Satus Creek summer steelhead run has accounted for as much as half the summer steelhead production in the Yakima River Basin in recent years.

Presently the only total fish population estimates available for Toppenish and Satus Creeks are for returning adult steelhead. Since the first estimate of 1,000 adults returning annually to Toppenish Creek and 600 adults to Satus Creek in the 1950s, the number of steelhead has steadily declined in both stream systems. The deterioration has been more severe in Toppenish Creek, with fewer than 100 fish returning per year since spawning

surveys began in 1989. The return of steelhead to Satus Creek in 1988 was similar to those of the 1950s, but the return has declined since 1988. The decline in steelhead runs to Satus and Toppenish Creeks roughly corresponds with the overall decrease in steelhead runs to the Yakima River. However, this does not mean that external factors totally control the size of fish runs to Reservation streams. Conditions within the streams themselves (water supply, habitat structure, temperature and fine sediment) are poor enough to account for most or all of the loss of steelhead in Satus and Toppenish Creeks. Rebuilding the declining populations of salmonids in Reservation streams depends on restoring the habitat in which these species grow, migrate and spawn.

Lacustrine environments support a different assemblage of fish species than riverine environments, especially among the species sought by humans. Low-lying sloughs and oxbows are inhabited by introduced sunfish species, most notably largemouth bass. Largemouth bass are very successful in ponds with open water and beds of rooted aquatic plants.

3.4 Social, Economic, and Cultural Resources

Few ethnographic and archaeological field surveys have been done in the lower Yakima River Basin, and most of these have been of limited scope and purpose. The available historic and prehistoric cultural resource information for the Valley has been reconstructed from evidence gathered from nearby areas (Galm et al. 1981, Leonhardy and Rice 1970, Swanson 1962, Cressman 1960). Although most of this previous work has been limited to sites found during Yakama Indian Nation cultural resource management surveys, timber sale surveys, irrigation ditch inspections, and thesis writing, the data gleaned has improved the understanding of the history and lifeways of the Yakama Indian Nation. A recent overview of the lower Yakima Valley was initiated by Cleveland and Griffin (1990) to better understand effects of land use policies and land use patterns in terms of socio/cultural change. This study considered historic and prehistoric land use, previous archaeological investigations, and traditional and present day land use factors, and concluded that the lower Yakima Valley area was widely used for winter villages (1990: 36).

Although the previous ethnographic and archaeological investigations tend to support the winter village settlement pattern, few physical sites have been found along the lower reaches of Toppenish and Satus Creeks or along that portion of the Yakima River project area due primarily to the lack of survey data. The sites that have been found tend to occur on higher ground, some distance from the mainstem of the Yakima River. As Cleveland notes, winter villages are known to occur in the Satus Basin extending from the mouth of that drainage up to the forested area and beyond in a continuous distribution. This settlement pattern is unknown for the Toppenish drainage, although winter villages are known to have existed along riparian areas of the Yakima River above and below Union Gap, some recorded, some known but unrecorded (1990:36-37). Recent archaeological surveys and studies have been few in number and confined to upland forested areas, which do not reflect the lower Toppenish and Satus Creek (winter village) settlement or Columbia Basin resource utilization patterns (Lothson, 1993).

3.4.1 Traditional Land Uses

Prior to the Treaty of 1855, the Yakama people, like most Columbia Plateau groups, employed a seasonal round of resource (hunting and gathering) procurement. This included the hunting of game, collection of roots and berries, and the seasonal exploitation of fish resources from the Columbia and Yakima Rivers. The seasonal round of activities appears to have some antiquity and is reflected in the distribution of prehistoric archaeological sites that occur along the Yakima River and Toppenish and Satus Creeks.

Traditional use of riparian areas by the Yakama Indian people is not well understood by today's historians, anthropologists and archaeologists. Many of the native plant species that were once used by all of the people as fiber resources, foods and medicines no longer exist in the project area floodplains or upland zones. Today basket materials, willows, berries and tule reed can be found by those who follow traditional lifestyles. Deer, beaver, muskrat, fish of several kinds and other native wildlife species are still hunted and netted with some frequency. Although physical survival for Tribal members does not depend on collected or hunted resources, they are an integral part of Yakama religious and social life. Fish, elk, deer and other collected foods are often served at traditional family gatherings and prominent tribal festivals.

Opportunities for gathering native vegetation are limited due to the decreased volume of native vegetation in the project area. Resources gathered for traditional purposes must be augmented by travel to adjacent mountain meadows and the Columbia River Gorge. Cattle grazing in the project area floodplain and riparian zones has affected the existing native vegetation and made the restoration of the total food and medicine resources that once existed there difficult if not impossible.

3.4.2 Historic Land Use

Conceptually, three major actions were identified that have affected past, present, and future land use patterns in the Yakima Valley project area. These were implementation of the allotment process, development of irrigated agriculture, and introduction of cattle grazing. The passage of the Allotment Act in 1880 and the subsequent change to irrigation and grazing land use practices (within Reservation boundaries) drastically changed the landscape and the traditional uses of that landscape. As irrigation and cattle grazing practices intensified both on and off the Reservation, native wildlife and vegetation species that were important as traditional food and medicine resources declined. Ultimately, the change in land use practices ended the traditional hunting and gathering pattern (seasonal round) of the Yakama peoples.

3.4.3 Current Land Use

Present-day land-use in the Project area includes livestock grazing, production of cereal grains, hops and mint, a national wildlife refuge, two cooperative Yakama Indian Nation/State of Washington waterfowl refuges, and numerous hunting clubs. As shown in

Table 3.2, much of the project area is held in trust for the Yakama Indian Nation, although the majority is comprised of individual Indian allotments and fee title lands.

Table 3.2: Project Area - Land Ownership Categories

Ownership Type	Acres	Percent of Total
Tribal Trust	15,595	31%
Indian Allotments	23,142	46%
Deeded (Fee Patent)	11,571	23%
	50,308	100%

3.4.3.1 *Tribal Income Sources*

As shown in Table 3.3 and Table 3.4, the primary use of the land within the project area is for agricultural purposes. Existing project area land use figures (data from Toppenish Creek, and Yakima River, North of Granger portions only) indicate that roughly 77 percent of the Reservation land proposed for wildlife mitigation is either idle or in pasture land status and not producing a high rate of income for either the Tribe or individual land holder.

Tribal income is produced from existing cattle grazing and other leases on Trust and Allotment lands. Lease rates vary dependent on the existing market conditions. An opportunity to produce additional Tribal income by lease of idle land for cattle grazing or other purposes incompatible with the Project would exist in other areas of the Reservation.

Table 3.3: Project Area - Land Use Type by Acreage

Land Use Category	Acres	% of Total
Agriculture		
Garden Crops	510	1.2
Forage	5,318	12.7
Grapes	1	0.0
Hops	193	0.5
Mint	882	2.1
Idle	10,826	25.9
Pasture	21,485	51.4
Orchard	97	0.2
Vegetables	2,362	5.7
Unspecified Crop	123	0.3
Subtotal	**41,797**	**94.7**
Built Up/Urban		
Agricultural	35	8.1
Commercial	143	32.9
Church/Cemetery	7	1.6
Mixed Commercial/Residential	2	0.5
Residential	247	56.9
Subtotal	**434**	**1.0**
Transportation		
Roads	480	86.3
Railroads	76	13.7
Subtotal	**556**	**1.4**
Water		
Ponds	59	5.9
Streams	949	94.1
Subtotal	**1,008**	**2.3**
Off Reservation (sample error)		
	269	**0.6**
Unclassified		
	12	**0.0**
Grand Total	**44,076**	**100**

Source: Yakama Indian Nation, GIS Land Use Database, 1994
Note: Information does not include the Satus Valley. It is assumed trends are similar.

Table 3.4 Average Project Area (Toppenish/Simcoe) Market Values

Agricultural Category	Acres	$Value/Acre	$Total
Garden Crops	510	16.70	8,517.00
Forage	5,318	432.00	2,297,376.00
Grapes	1	176.00	176.00
Hops	193	3,202.00	617,986.00
Mint	882	12.00	10,584.00
Idle	10,826	0.00	0.00
Pasture	21,485	10.50	225,593.00
Orchard*	97	5,274.00	511,578.00
Vegetables**	2,362	1,721.00	4,065,002.00
Unspecified Crop	123	1,232.00	151,536.00

Source: Wapato Irrigation Project: 1993 Crop Report.
* Average of all Orchard crops reported
** Average of all Vegetable crops reported

3.4.3.2 *County Revenues Produced*

Presently property taxes are paid to Yakima County for all deeded (fee patent) lands located on the Reservation. Presently this includes 23 percent of the project area or approximately 4,683 hectares (11,571 acres). Yakima County Assessor's Office and the Washington Department of Revenue report several tax codes for these private held lands, and taxes that are assessed at various rates. As property is acquired for the Project and converted to trust status, more specific tax revenue information can be identified and concerns addressed.

3.4.3.3 *Agricultural Practices: Chemical Management*

Application of a wide variety of herbicides and pesticides is a common farm practice in the Yakima River basin At the present, the type and application of a wide variety of farm chemicals used in the State of Washington are unregulated. On average it is estimated that project area croplands (10 percent of agricultural lands) receive a high level of herbicides and pesticides on an annual basis. At the present, lessee herbicide applications in the project area are controlled through the BIA Farm Plan. The EPA , BIA and State of Washington require individual farmers to record and report chemical usage on a 7 year basis. Two handbooks, *Pacific Northwest Weed Control Handbook*, and the *Crop Protection Chemical Reference*, provide references for what chemicals to use. State restricted chemicals, and label restrictions by specific crop (when and where applied) are also provided. At this time cinbar and atrazine are the only herbicides with restricted usage due to residual soil effects and moderate to high potential for leaching into the water table (Mains, 1994).

Even though the application of synthetic organic compounds is extensive on agricultural land in the Yakima River basin, relatively few samples have been collected to

determine spatial and seasonal distributions of these compounds in the soil and aquatic environments. Data have been collected from about 30 sites in the basin, and about 50 percent of the samples have been collected from the Yakima River at Kiona near the terminus of the basin. About 85 percent of the trace-organic-compound concentrations from 1968-83 water years were reported below the minimum analytical reporting levels.

During the peak irrigation season, concentrations of several trace organic compounds at the Kiona gauge have exceeded State water standards for chronic toxicity of freshwater aquatic life. Primary toxins include aldrin/dieldrin, endosulfan, DDT and its metabolites, endrin, parathion, and polychlorinated biphenyls (PCB). However, none of these concentrations have exceeded standards for acute toxicity. From 1968-82 decreases in DDT endrin, parathion, and dieldrin in water and fish tissue has occurred due to prohibition of DDT and dieldrin use (USGS, 1992).

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

No-Action: Alternative A

Alternative A would allow for the continuation of the declining wildlife and wildlife habitat trends and project area cultural resource, endangered species, water quality, and socio-economic conditions as established in Chapter 3. With or without the proposed actions, the human population will continue to grow in the Yakima Valley, increasing strain on the natural resources of the project area. Without wetland and riparian wildlife habitat restoration, further declines in native vegetation, fish, and wildlife populations are predicted. Agricultural and urban land use development trends would continue to fluctuate with local, regional, and national economic patterns. Preferred lifestyles and land practices of traditional Tribal members would continue to decline as more and more natural areas are converted to agricultural and other developed uses. If No-Action is taken, the Yakima County tax base would not be affected as fee patent (private) land within the Reservation would not be converted to trust status unless acquired through other Yakama Indian Nation programs.

Selection of Alternative A would not meet the need for mitigating wildlife and wildlife habitat adversely affected by the construction of Bonneville, The Dalles, John Day, and McNary dams and reservoirs. Selection of Alternative A would limit the ability of BPA to satisfy terms and conditions of the Washington Wildlife Mitigation Agreement, maintain consistency with the Council's Fish and Wildlife Program, and increase the quality and quantity of wetland, riparian, and upland wildlife and wildlife habitat on the Yakama Indian Reservation.

Land Acquisition and Habitat Enhancement: Alternative B

The objective of Alternative B is to protect and enhance the long-term quality of wetland, riparian, and upland wildlife habitats within the Yakima Indian Reservation project area. With BPA funding, sites within the lower Yakama Indian Reservation project area would be dedicated and managed for wildlife values in perpetuity.

Selection of Alternative B would meet the need for mitigating wildlife and wildlife habitat adversely affected by the construction of Bonneville, The Dalles, John Day, and McNary dams and reservoirs. Selection of Alternative B would increase the quality and quantity of wetland, riparian, and upland wildlife and wildlife habitat on the Yakama Indian Reservation. Alternative B would provide the means for BPA to maintain consistency with the interim Washington Wildlife Agreement, the Council's 1989 Fish and Wildlife Program Wildlife Rule, and the 1993 Phase IV Resident Fish and Wildlife Program Amendments.

4.1 Physical Environment

4.1.1 Climate

Proposed Alternative B activities would have no known effect on climate.

4.1.2 Geology

Proposed Alternative B activities would have no known effect on geology.

4.1.3 Soils

Alternative B objectives include restoration of former wetland areas for wildlife habitat purposes. Former wetland areas are evident today by the presence of remnant hydric soils and indicator plants such as cattails. In the long term, hydric (wet) soil conditions are expected to be increased in the project area as wetlands are returned to their former conditions. Of potential concern are proposed activities that may disturb or expose poorly drained Toppenish-Umapine soils near water bodies. Care must be taken to avoid an increase in the rate of soil transport and stream sedimentation. In project areas with these soil types, the quick re-establishment of native vegetation communities and natural land contours is recommended.

The timing of shoreline, riparian, and upland enhancement activities is important to avoid potential soil compaction, sedimentation in streams, and other adverse effects on aquatic organisms. Enhancement activities should take place only in the driest portion of the year when streamflows and water levels are at their lowest and in coordination with Yakama Nation Water Code, Fisheries, and Environmental Protection Departments. When proposed activities such as establishing native vegetation plots could disturb and/or expose poorly drained soils, it is recommended that erosion risks be controlled by planting vegetation cover crops, applying ground mulch, and watering of the newly established plantings.

Negative effects to prime farmland designations would not be expected from the proposed restoration of wetlands, because restoration of wetlands and inundation of soil is not an irreversible process. As viewed by the Soil Conservation Service and the BIA, restoration of wetlands is a temporary change that would not change the prime and unique designation or preclude farm use in the future if it was required by the declaration of a national emergency. The prime and unique designations in the other riparian and upland areas that are not inundated would not be affected because proposed wildlife enhancement activities and management of these sites could also be reversed and the land converted back to farm use if required by the declaration of a national emergency (Hipple, C., and T. Berkompas, 1994).

4.1.4 Air Quality

Although burning of outdoor vegetation could occur on small disbursed plots to remove undesired weedy vegetation, this alternative is not expected to increase PM-10 (smoke/particulate matter less than 10 microns), or carbon monoxide levels in the project area. As native vegetation plots are established and increase in density, they out-compete and shade out weedy vegetation. Over time this would effectively decrease the amount of required burning activities as compared to existing burning levels which are required for maintaining agricultural conditions.

To minimize potential smoke emissions in the near term, outdoor burning permits would be obtained from the local Fire District prior to any burning activities. Burning would occur only on days authorized by the Yakima Clean Air Authority. Air quality levels for PM-10 and Carbon monoxide emissions would be minimized by seeking alternatives to burning, and/or meeting all conditions of the burning permit.

4.2 Water

4.2.1 Floodplains/Wetlands

Wetland restoration activities as proposed in Alternative B would be guided by the 1994 restoration definitions of Wenmann and Kunz which state these as the necessary, "actions taken that result in the re-establishment of wetland structures, processes, and functions in areas where wetlands have been altered, degraded, or destroyed." Land contours of approximate 1-3 foot cuts and earthberms intended to hold water in sites ranging from 100 acres to an acre in size; diking, ditching, piping or pumping to move water for filling or refilling purposes would be designed to minimize adverse effects, and would be developed only to the extent necessary to restore the land to a condition similar to natural wetlands or river channel characteristics. Over the next 5-10 years, such activities could involve restoring up to 2000 wetland acres in several dispersed sites.

Because development of permanent buildings, roads, or facilities are not proposed as part of this alternative, adverse flooding effects would not be expected. Potential near term effects to existing wetland sites may include varying degrees of increased soil compaction, water turbidity, impacts to existing vegetation, and disturbance to existing wildlife populations. These potential effects are discussed below in further detail. Site specific effects may be reviewed in further detail as individual properties are acquired for the Project.

4.2.2 Water Quantity

Activities proposed in Alternative B would have no measurable effect on the net amount of surface water leaving the project area. Potentially, some differences may be observed in the timing and return of Toppenish and Satus Creek streamflows as wetlands are reestablished and a more natural hydrograph pattern occurs. Because irrigation practices are likely to remain the same above and below the project area, observable

change in Yakima River water quantity is unexpected. Ground water levels should become higher in localized areas as the wetland acreage increases. Water delivered through the WIP to the project area properties for wildlife purposes should be similar or less than the amount currently delivered for agricultural production. The Yakama Indian Nation would attempt to transfer all water rights appurtenant to the real property purchased. Water rights would be transferred to allow their use for wildlife habitat.

4.2.3 Water Quality

Protection of existing riparian systems and restoration of damaged riparian areas as proposed in Alternative B would increase bank stabilization, increase shading and lower stream temperatures, and reduce inputs of sediment and pollutants into Satus Creek, Toppenish Creek and the Yakima River. The installation of water control structures, land contouring, and vegetation re-establishment, however, may temporarily increase sedimentation in water courses to some degree during the time of construction. These effects are predicted to be local and of short duration. All construction work performed in or near bodies of water must be planned and completed in coordination with the Yakama Nation Water Code, Fisheries, and Environmental Protection Departments to better ensure water quality conditions are maintained.

Alternative B would be beneficial for the water resources of the Yakama Nation in the long term. Re-establishment of native vegetation communities and more natural landforms on previously farmed lands would reduce the amount of agricultural runoff entering the streams. Wetland restoration would contribute locally to the increase in ground and surface water quality, raise groundwater levels, and buffer the effects of floods. Wetland surface return flows are expected to equal or could exceed the quality of the stream itself in terms of specific water quality measures including temperature, pH, dissolved oxygen, fecal coliform, turbidity, nutrients, and toxicants. This is due to the physical effects of sediment settling, uptake of nutrients in vegetation, stream shading, and other natural wetland processes. Prior to the return of wetland flows into project area stream courses, monitoring of wetland hydrology, aquatic vegetation, and wetland water chemistry should be initiated to quantify the amount of change in water quality conditions over time, and to meet applicable Federal or Tribal permit requirements.

4.3 Biological Resources

4.3.1 Wildlife

The process of securing and enhancing land for wildlife as proposed in Alternative B would provide both immediate and long term benefits to wildlife populations. Immediate benefits would be realized by the protection of habitat qualities present at each site and by the termination of agricultural and other land use practices that decrease wildlife habitat value. Removal of livestock grazing in slightly disturbed habitat areas (such as the gallery riparian forests along the Yakima River) would be sufficient in itself to improve habitat conditions and increase healthy wildlife populations. In heavily disturbed areas or those altered by agricultural and other competing land uses, land protection

exclusive for wildlife purposes would maintain existing habitat values and insure that wildlife populations are not further reduced.

Exotic vegetation removal and land contouring activities as proposed in Alternative B should be completed in a manner and time frame that would least disturb the wildlife present. Disturbances due to construction and other enhancement activities are expected to be of short duration, and localized in nature. Near term disturbance of wildlife should be offset within one growing season by the greatly increased habitat values. To avoid recurring disturbances, reconstruction of habitats should be designed to the extent possible for minimizing the amount of annual operation and maintenance required. Monitoring and evaluation activities such as water quality sampling, and visual surveys of wildlife and wildlife habitat would have no known adverse environmental effect.

4.3.3.1 *Alternative B: Potential Wildlife Effects by Cover Type*

Riparian forest, shrub and herb: The removal of livestock could increase plant cover and wildlife benefits within a single growing season. As native trees reestablish and mature, cavity dependent birds such as wood ducks and Lewis' woodpeckers would be provided with increased nesting habitat. Perching birds and raptors would also benefit from the increased diversity of forest layers. Improved riparian shrub and herb conditions would increase nesting, feeding and cover habitat to bird species such as yellow warblers and California quail, and to mammals such as mule deer and cottontail rabbits.

Agricultural: Many species of wildlife would benefit from conversion of croplands back to native vegetation. Restoring sloughs and side-channels on leveled and drained farmlands would benefit many wetland associated species, such as American bittern, spotted sandpiper, and muskrat. Establishing native grasses on existing croplands could quickly increase available habitat for many upland and waterfowl species and insure that food is available for wildlife during the reproductive season and other critical periods of the year. It is recommended that grain and corn crops beneficial for winter wildlife forage also be grown as feasible to augment winter food sources.

Sand/gravel/cobble/mud and lacustrine: Due to artificially accelerated eutrophication rates, many of the lacustrine systems in the project area do not meet the habitat requirements of local wildlife. Restoration of these systems would increase shoreline habitat for waterfowl production, shorebird feeding and use by colonial nesting birds. Proposed enhancement activities such as land contouring or restoration of water control structures may create short term wildlife disturbances. To avoid potential impacts to existing waterfowl, shorebirds, colonial nesting birds, or other wildlife populations, enhancement activities should be timed to occur from mid-summer to late-winter when breeding activities do not occur.

Riverine: Restoration of habitats adjacent to riverine areas would contribute to increased water quantity and quality. In the long term this could increase the amount of submersed macrophytes and invertebrates in the river and creek systems. Waterfowl and other avian species that feed on these plants and animals would benefit in direct proportion to the amount of food supply available.

Emergent wetland: Because many species of wildlife use wetlands for a portion of their life cycles, increased wetland acres should begin an upward trend for a large number of native wildlife populations in the Yakima valley. Waterfowl production would immediately benefit from the increased escape, nesting, and feeding cover. Overall wildlife species diversity would improve in the river and creek systems with the increase in wetland habitat types. Increased wetland acres could provide for the return of nesting sandhill cranes to the valley floor.

Enhancement activities such as land contouring and well, ditch, pipe, or pump establishment may create short term disturbance to wildlife populations presently using the existing wetlands. To the extent feasible, enhancement activities should be planned to avoid critical nesting and brood-rearing seasons. Disturbance of existing site vegetation (even though of exotic plants) could temporarily reduce the habitat quality of a wetland area. To avoid potential impacts to waterfowl, vegetation manipulation or weed control activities should be performed after the waterfowl nesting and brood-rearing season.

Shrub-steppe/grassland: Improving the condition of the upland native plant community should increase the quantity and quality of habitat available for a wide variety of wildlife species. Ground nesting bird populations such as western meadowlark, northern harrier, and mallard should benefit in direct proportion to the increased amount of undisturbed shrub-steppe and grassland cover. Small mammal populations and raptors are also expected to increase. To avoid potential impacts to ground nesting bird populations, all ground work including the use of sprinkler irrigation should be avoided during the spring reproductive season.

4.3.2 Threatened or Endangered Species

Wintering bald eagles are the only federally listed species in the project area. Bald eagle and other raptor populations should directly benefit from improved wetland and riparian habitat conditions. Increase of bald eagle nesting sites may result in actual nesting activities.

Because the primary food of wintering bald eagle populations in the project area is fish and ducks, an increase in wintering waterfowl numbers would increase bald eagle foraging and feeding opportunities. Additionally, protecting the large riparian forest cover type from future livestock grazing would encourage recruitment of new cottonwood stands, and help insure that the number of available hunting perches and roost sites for eagles are maintained and/or increased over time.

It is anticipated that near term adverse effects on wintering bald eagles would be minimal. To minimize any potential adverse effects it is recommended that the majority of initial habitat enhancement work in riparian areas occur from late April through October (a time when bald eagles are not present). To further reduce potential disturbance of bald eagles, public access into the project area by motorized vehicles would be allowed only when bald eagles are not present.

4.3.3 Vegetation (Wildlife Habitat)

An important component of Alternative B is the restoration of native vegetation communities. Currently, only remnants of native plant communities (preferred by wildlife for its intrinsic habitat value) remain in the project area. The project area is dominated by introduced plant species. Re-establishment of native vegetation would provide the greatest habitat value possible and long term benefits to wildlife and fish populations, and to traditional Yakama Nation cultural uses.

Site protection activities and termination of land use practices harmful to native vegetation as proposed in Alternative B could provide increased wildlife habitat benefits within a single growing season. Potentially, management activities may be required to control weed infestations in disturbed areas and/or areas with exposed soils. Although labor intensive at the beginning, restoration and enhancement activities that restore large and vigorous native plant communities should provide the most cost-effective and practical means of future weed control. Proposed operation and maintenance activities would focus on increasing native vegetation conditions at each site acquired for the Project. Proposed monitoring and evaluation activities would guide these activities to ensure that success is achieved.

Near term effects of native vegetation restoration may involve the potential disturbance of wildlife populations presently using the existing vegetative cover types. Potential effects to ground nesting birds could result from the removal of non-native weed species in spring and early summer. It is recommended that management activities that include burning or herbicide treatments be conducted at the appropriate seasons and timed to avoid any adverse effects to wildlife species.

4.3.3.1 *Alternative B: Potential Effects on Vegetation by Cover Type*

Riparian forest, shrub and herb: Alternative B would increase the quality and diversity of the riparian cover types now present along the Yakima River. Control of grazing practices within the riparian corridor should allow for quicker restoration of native shrubs and herbs, and allow hardwood trees to propagate. Cottonwood recruitment for the first time in decades should increase habitat benefits within a relatively short time frame (5-10 years) as the young trees grow in height. In some areas with existing native riparian shrub and grass communities, habitat improvement may be observable within a single growing season. Along Toppenish and Satus Creeks, where land use practices have decreased habitat values for most of the riparian cover types, longer periods may be required to restore native plant communities. Depending on local site conditions, it is expected that vegetation replanting and control of cattle grazing could increase wildlife habitat benefits in the long term. In heavily degraded areas, habitat improvement may require a longer period, ranging from 10-20 years, and take at least 3 years for an observable response.

Agricultural: As proposed in Alternative B, native plant communities would be replanted on most agricultural croplands. Depending on the site, improved habitat conditions may be expected within 3-7 years. Negative effects to wildlife are not predicted; corn and other grain crops could be grown and left unharvested to increase critical winter food

supplies. Sites that were once leveled and drained for crop production purposes and no longer useful as overall wildlife habitat would be contoured to restore previously existing wetlands, creeks, and side-channels. Although most existing agricultural habitat types would be effectively removed, habitat quality is expected to increase in direct proportion to the extent native plant communities are reestablished. To avoid potential erosion effects in the near term, cropland sites would be revegetated with native plants or cover crops immediately following ground work activity. To further improve habitat quality, fencerows adjacent to the remaining cropland would be established and to the extent possible planted with native vegetation. This would enhance the diversity of the native plant community and provide valuable escape cover for wildlife.

Sand/gravel/cobble/mud and Lacustrine: Most lacustrine and shoreline habitat types occur along the Yakima River corridor between Granger and Mabton. The effect of controlling or reducing cattle grazing as proposed in Alternative B would provide for immediate reduction of nutrient inputs and shoreline disturbances. In general, water level manipulation to expose and dry out root systems in conjunction with sediment removal to deepen ponds would allow for near term control of shallow water weed species (such as water lily, coontail and bladderwort). Water level drawdowns may also promote quicker compaction of bottom sediments and when performed with removal of carp populations (by netting, fishing, or concentrating of schools for predators), could encourage the establishment of a wider diversity of native plants such as sago pondweed and other submersed macrophytes. Under ideal conditions, habitat quality and the diversity of the lacustrine and shoreline areas could improve at a rapid pace and be restored within 1-2 years.

Dependent upon site-specific conditions, to be analyzed in further detail as property is acquired for the Project, potential near term effects may include a temporary increase in water turbidity in localized ponds and sloughs, and/or other water quality factors affecting aquatic organisms. Any work in or near in water bodies involving the potential for dredge materials, or soils entering streams or waters of the United States shall be minimized. The use of heavy equipment in water bodies shall be avoided to the extent possible. When sediments are removed they could be used to build berms or could be removed to approved sites to avoid adverse effects or to better comply with terms or conditions established in Federal permits and applicable Tribal Water Code requirements.

Riverine: Due to the presence of water, restoration of native plant cover types in riverine or creek bank zones could improve wildlife habitat quality in a relatively short period, or to the point of observable results within 2-5 years. The riparian and wetland enhancements as proposed in Alternative B would encourage shallower groundwater tables in localized areas, and more permanent river and creek surface flows with clearer, colder water. Submersed macrophytes may increase in these areas providing substrate for macroinvertebrates, fish and wildlife. Cattle removal would lessen the problems of bank erosion, and shrub revegetation may promote bank stabilization to varying degrees. Any work in or near water bodies involving the potential for dredge materials, or soils entering streams or waters of the United States, or the use of heavy equipment shall be avoided to the extent possible and comply with terms and conditions established in Federal permits and applicable Tribal Water Code requirements.

Emergent wetland: Bich et al. (1991) estimated that there are approximately 1,500 acres of emergent wetland remaining in the project area. Restoration activities such as drain removal and water source development would allow for an increase of wetland acreage within 5-10 years. Due to the availability of water, plant response is relatively rapid in aquatic environments. Habitat quality of the existing wetlands could dramatically improve within 2-3 years. In the long term, wetland enhancements would result in an increase of wetland plant and animal diversity, and in vegetative cover types that range from permanent hemi-marsh to seasonal or temporary shallow water areas. In some areas it is anticipated that communities of native emergent plants such as arrowhead and burreed could be reestablished within a single growing season. These native plant species have returned in past wetland enhancement projects along Toppenish Creek without planting efforts.

Although wetland restoration activities would take place primarily in areas that have been disturbed from farming and grazing activities, potential disturbance to existing native vegetation could occur. In areas where native wetland vegetation could be impacted, all disturbance activities must be avoided to the extent possible. Where land contouring activities are conducted, existing topsoils should be stockpiled, replaced, and revegetated on completion of groundwork.

Shrub-steppe/grassland: Depending on specific site conditions the quantity of shrub-steppe and grassland vegetation and the quality of wildlife habitat could be increased in 2-3 years. Observable improvements in habitat suitability could result within 3 years in some areas. By excluding cattle from existing native grass pastures an immediate improvement in productivity of native plant species that are typically grazed such as bluebunch wheatgrass should be observed. As a result the habitat quality of ground nesting birds could be increased within a 1-2 year timeframe. Controlling competing weed species (such as thistles and knapweed) that increase with livestock grazing use should also favor native plant productivity. Potentially, native grass and shrub communities could be partially restored in heavily disturbed sites within 3-5 years. In areas with good soil conditions or in areas that are close to a water source restoration could be expected to occur at a quicker pace. Irrigation in the form of gravity flows or sprinklers is recommended to assist in native grass establishment, and as needed to maintain native grass stands. Once the native plant communities are reestablished, however, it is expected little irrigation should be required.

Potential near term effects of grassland restoration could involve native vegetation disturbances due to proposed land contouring, water supply and weed control activities. Because such actions would take place only in areas that have either been disturbed in the past or contain large non-native plant communities, negative effects to native vegetation species are not predicted. To avoid any potential impact to remnant native plant communities, however, areas not requiring restoration should be identified and protected.

4.3.4 Fisheries

Water supply, water quality, and habitat complexity are important for fish production. A healthy riparian corridor is characterized by a dense, diverse and multi-

storied community of native grasses, forbs, shrubs and trees. Healthy root systems deter bank erosion, creating overhangs beneath which fish can hide. Shading from the foliage of live trees and shrubs provides further security for fish and lowering of summer water temperatures. Fallen foliage is a critical food source for aquatic insects consumed by fish. Fallen trees are the source of logs and root wads that salmonids also use for cover.

Habitat needs of salmonids shift as the fish grow and the seasons change. For example, young fish use crevices between rocks in winter to avoid predators without expending precious energy to stay in position, and returning adult steelhead seek resting pools and spawning riffles. These diverse requirements illustrate the importance of habitat complexity for fish production. Streams in undisturbed watersheds have the variety of channel configurations, cover types and substrate sizes that native fish species and their prey are adapted to utilize. Developing a stream and isolating it from its floodplain by diking and channelization makes it unsuitable for fish production even if water quality parameters are within acceptable limits. Although fish production is not a part of this alternative, restoring wetland and riparian systems would help to increase fish habitat structure and quality over existing conditions.

Alternative B would restore the original diversity of instream and riparian habitats, rather than create one type of habitat at the expense of others. Water would be diverted at some locations during periods of medium and high stream flow to recreate sloughs and backwaters which once filled naturally during those times. It is recommended that water use objectives and streamside habitat enhancement activities be coordinated with the Yakama Indian Nation Fisheries and Water Resource programs whenever possible to provide for mutually beneficial stream side conditions to which native fish populations have also adapted.

The following recommendations and should be coordinated with fishery staff prior to stream corridor activities when applicable to avoid any potential effect on fisheries. If filling newly restored wetlands should occur during low streamflow periods, a source of water other than the stream or the associated aquifer (such as WIP water) would have to be utilized. Monitoring of wetland water chemistry is necessary to ensure that wetland return flows to the stream in terms of temperature, dissolved oxygen and turbidity will be at least as high as that of the stream itself. Monitoring activities and results should be coordinated with BIA, and Yakama Indian Nation, Fisheries and Water Resource Programs prior to wetland surface water flows entering stream courses.

Alternative B cannot reverse the water quality and water supply problems that begin upstream of the project area, and worsen downstream. These cumulative effects are currently being addressed in other ongoing Tribal, State, and Federal programs, which would be less effective without the habitat restoration proposed in this alternative.

4.3.4.1 *Alternative B: Potential Effects on Fisheries by Cover Type*

Riparian forest, shrub and herb: Negative near term effects are not anticipated as a result of fencing, weed control and planting as long as machinery is not used in streams or on stream banks. Native riparian species have a diversity of functions to which native fish

species are adapted. Restoring the original riparian gallery optimizes conditions for population growth of native fish species. The continuation of uncontrolled livestock grazing is incompatible with riparian restoration. To avoid potential effects to fisheries, fencing should be used to manage grazing near aquatic and in all riparian habitats.

Agricultural: The conversion of agricultural lands which are plowed, tilled, and cultivated on an annual basis back to native habitats that restore year round vegetative cover would increase fish production by reducing the amount of sediments and agricultural chemicals entering the ground and surface waters of the project area.

Sand/gravel/cobble/mud and Riverine: No measurable adverse effects to fish are predicted by protecting shorelines through fencing out livestock and reestablishing native plants. In the long term such activities are essential to the maintenance and/or restoration of salmonid rearing habitat of Satus and Toppenish Creeks and the Yakima River. This enhanced rearing habitat is necessary for the return of healthy Yakima River Basin salmonid populations.

Lacustrine: The eutrophication process in the remaining Yakima River oxbows and sloughs has been accelerated by stream sedimentation, nutrient loading from livestock waste, and agricultural fertilizers transported into stream systems. Removing sediment, restricting cattle from shorelines, and controlling aquatic vegetation through (drawdown and refill) water level manipulations may slow this process to varied degrees. Cleaner and deeper water levels would benefit the small largemouth bass populations and allow this species to compete more effectively with the large population of carp that presently dominate the lacustrine environment.

Potential near term fishery effects may include increased rates of turbidity. Removing sediment and other work in or near water bodies involving the potential for dredge materials, or soils entering streams or waters of the United States, or the use of heavy equipment shall be avoided to the extent possible. Potential fishery effects will be avoided by complying with terms and conditions established in Federal permits and applicable Tribal Water Code requirements.

Emergent wetland: Filling of wetlands, diking and water level control in Yakima Basin floodplains has decreased wetland habitat values on a large scale. Restoration of wetlands as proposed in Alternative B, would be beneficial to fish populations when activities are designed and used to mimic pre-development floodplain conditions. The long term result should be an increase in the quantity of project area salmonid populations in the river and creek systems, and an increase in native warmwater fish species in the wetlands themselves. Any work in or near water bodies involving the potential for dredge materials, or soils entering streams or waters of the United States, or the use of heavy equipment shall be avoided to the extent possible and comply with terms and conditions established in Federal permits and applicable Tribal Water Code requirements.

Shrub-steppe/grassland: Stabilizing shrub/steppe habitat conditions through fencing and native vegetation re-establishment would contribute to erosion control on one of the greatest sources of excess sediment in Satus and Toppenish Creeks.

4.4 Social/Economic and Cultural Resources

4.4.1 Historic and Traditional Land Use

Although detailed inventory surveys and mapping of surface features have not been extensively undertaken on the Yakama Indian Reservation, a 1993 cultural resource reconnaissance survey determined the existence of cultural resource sites within the project area. Cultural surveys will be conducted by Yakama Indian Nation staff in an effort to prevent adverse effects and to meet Federal and Tribal requirements prior to site-specific ground disturbing activities.

In accordance with the requirements of the Yakama Indian Nation, Land and Natural Resources Policies Plan, Yakama Indian Nation cultural resource staff shall participate in the site planning process and coordinate the cultural resource survey and all other efforts required to protect cultural resources. Upon acquisition of property for the Project, the Site Plan developed for each location shall document how proposed activities:

- Affect any known prehistoric, historic, or ethnographic site
- Protect, preserve, stabilize, and enhance (education, respect and restoration) native North American peoples traditional values and places
- Provide for alternative locations for various developments or actions if the need should arise
- Ensure that cultural resources take precedence over all other intended uses in the event of a conflict
- Ensure compatibility of habitat management activities with the cultural resources present or how they can be made compatible
- Are undertaken in accordance with the accepted management and research protocols established for the Project (Lothson, 1993).

The wildlife enhancement activities as proposed in Alternative B are designed to protect, preserve, stabilize, and enhance the historic, prehistoric and traditional use sites and areas. Four categories of actions will be used to avoid potential cultural effects when such sites are identified: 1) total avoidance of known cultural resources by wildlife enhancement actions; 2) the creation of buffer zones designed to protect sites from looting and/or other negative impacts; 3) stabilization of endangered sites and locations; and 4) revegetation of those areas impacted by cattle grazing and other ranching or agricultural activities. In all instances the management and research protocols as outlined for the Satus Creek Wildlife Recreation Area will be followed to avoid adverse effects to historic and prehistoric properties or other cultural resources (Lothson, 1993: 6-10).

4.4.1.1 *Cultural Resource Mitigation Actions*

Avoidance (Protection): Site-specific surveys shall be used to determine which areas must be totally avoided because of their historic and cultural importance to the Yakama Indian Nation. In such areas either no activities would be allowed, or activities would be restricted to specific actions identified in the site-specific management plan. For example, areas where pit houses or burial sites are located would be avoided.

2) Buffer Zones (Preservation): Buffer zones shall be established to increase protection for sensitive sites in which little human activity is desired. The establishment of thick native riparian shrub and forest species is recommended for establishing these barriers. Because the buffers would be composed of natural vegetation, they should not draw undue attention to those areas they are protecting.

3) Stabilization: Wildlife enhancement activities as proposed in Alternative B would be designed to the extent possible to provide wildlife benefits while avoiding adverse impacts to historic or cultural sites. Stabilization of sensitive cultural resource sites shall be undertaken in areas where the sites are in danger of being lost because of past land use practices. For example, sites near eroding river or creek banks can be stabilized to varying degrees through the re-establishment of native riparian vegetation. Such opportunities provide an example of the compatibility of wildlife habitat restoration goals with those that increase protection for the historic and cultural resources of the Yakama Indian Nation.

4) Revegetation (Enhancement): As proposed in Alternative B, the revegetation of native plants in areas where cattle or other land use activities have removed the ground cover is compatible with cultural resource goals. Revegetation goals for wildlife would benefit cultural resources by protecting sites from looting or vandalism. An opportunity to provide native plants beneficial for both wildlife and as food, medicine, and materials sources should be provided in those areas formerly used for traditional gathering. This method would present an opportunity for wildlife and historic and cultural resource goals to be achieved simultaneously.

4.4.2 Current Land Use

In the long term, wetland restoration activities as proposed in Alternative B could benefit current farm uses in those areas directly adjacent to land parcels selected for the Project. For example, the increase of groundwater tables in adjacent low lying pasture lands could enhance plant growth and lengthen the period of grazing or farming operation. As land is acquired for the Project, site-specific monitoring of wetland hydrology would be conducted to minimize risk of flooding of crops or pastures. Because weed control would be an important component of all Site Plans, adjacent landowners should benefit by the removal of weed seed sources. Crop depredation due to increased wildlife abundance would not be expected, because proposed activities are directed at increasing waterfowl production and not increasing waterfowl wintering habitats. Waterfowl populations in the spring and summer months use natural wetlands and grasslands for their food and cover needs. Wintering populations are dependent on regional land use patterns which are little influenced by habitat restoration activities of this kind.

Although current zoning categories are not expected to change as a result of this alternative, potential displacement of current land use practices and/or activities may result as pasture land is incorporated into the Project. Because land condemnations would not be practiced and site specific land use changes would take place only at the consent of the land owner or lease holder, severe displacement rates are unexpected. As proposed in Alternative B, fee patent lands would be purchased, allotments would be purchased or

leased pending the approval of the allottee, and tribal lands could be incorporated only in consultation with the Yakama Nation Tribal Council. In situations where trust land would be included in the Project, current leases would not be renewed or would be amended to conform to Project objectives. Lease holders displaced by project activities may consider relocation to idle acres presently existing on the Reservation. If existing leases are acquired for the Project which result in relocation of landholders to other properties, such activities would take place only at the time of lease expiration or with the prior agreement of the lessee. Tribal income from the Leasing Program is not expected to decrease as a result of the Project. As part of acquiring and protecting Tribal Trust or Indian Allotment lands for the Project, new site-specific leases would be established for those individual parcels that are selected.

Recreational use may increase as the project progresses. The Yakama Indian Reservation presently is host to many upland bird and waterfowl hunters each fall and winter. According to Yakama Indian Nation annual hunting surveys, over half of visiting hunters reside outside of the Yakima Valley and thus are responsible for stimulating the local economy. Public waterfowl hunting opportunities are limited to a few Tribal and Federal public hunting areas; many hunting areas along the Yakima River and Toppenish Creek are subleased and operated as private hunting clubs. In the long term, inclusion of Project properties into the Tribe's public hunting program could increase visitation and hunting revenues to the Yakama Indian Nation and income of local businesses that cater to the out-of-town hunting public.

Potential Yakima County revenue effects of converting private lands on the Reservation to trust status could occur at various amounts and times as the Project is developed. Yakima County concerns will be addressed as individual fee patent sites are acquired and the magnitude of tax revenues impacts can be determined.

The extent of herbicide applications as proposed in Alternative B is expected to be less than currently applied for agricultural purposes. In the long term, chemical use should decrease due to the lesser degree of soil exposed to seed sources, the crowding or shading out of weed species as native plant communities expand, and alternative weed control activities. As land is acquired, site-specific herbicide selection shall conform to BIA Farm Plan requirements regarding chemical and label restrictions. Chemical applications shall be coordinated with the Yakama Indian Nation Weed Control Program to ensure near term effects of chemicals are avoided. This would benefit non-targeted species and lessen the risk of chemicals being transported to ground water or streams.

CHAPTER 5: COMPLIANCE WITH ENVIRONMENTAL PROTECTION STATUTES

Consistent with the requirements of the National Environmental Policy Act (NEPA) and the implementing regulations issued by the Council on Environmental Quality (40 CFR 1500), this assessment includes a review of project compliance with relevant statutes and the executive orders listed below.

5.1 Federal Requirements Applicable To This Project

- **Endangered Species Act: 16 U.S.C. 1531 et seq.**

BPA consultation with the U. S. Fish and Wildlife Service (USFWS) pursuant to Section 7 of the Endangered Species Act has been completed. Adverse effects to listed species are not anticipated.

- **Cultural Resource Legislation, Executive Order 11593; Archaeological and Historical Preservation Act of 1966 as amended, 16 U.S.C. 469 et seq., Public Law 92-291**

A cultural resource reconnaissance survey of the Satus Creek area was conducted by Yakama Indian Nation archaeological staff in 1993. The report indicates a high probability of the presence of prehistoric and historic resources of significance within project area locations (Lothson, 1993). BPA has contacted the Washington State Historic Preservation Office (SHPO) to request a search of the State data base. Phase I cultural resources inventory and reconnaissance surveys of acquired lands will be undertaken prior to any wetland enhancement activities. These surveys will follow the Yakama Indian Nation management and research protocols established for the Project (Lothson, 1993) and the Federal and state guidelines established for such surveys. No management activities will be conducted until field surveys are completed. If a cultural or historical resource is discovered during a field survey, BPA, Yakama Indian Nation, and BIA will report findings and discuss mitigation measures with the appropriate SHPO authorities. Yakama Indian Nation will avoid enhancement activities that will adversely impact historical or cultural resources. No significant adverse impacts to historical properties or cultural resources are anticipated.

- **Executive Order 11990: Protection of Wetlands**

All Federal agencies are required to minimize the loss or degradation of wetlands under the provisions of this directive. The Project objectives of rehabilitating and enhancing riparian and wetland areas for wildlife habitat are consistent with this directive. Although existing wetland soils and vegetation may be temporarily disturbed during enhancement activities, the habitat treatments should result in a long term net gain of wetland acres.

- **Effects on the Waters of the United States; Permits for Structures in Navigable Waters, Rivers and Harbors Act, 33 U.S. C. 401 et seq., Federal Water Pollution Control Act (See 404 as amended); Clean Water Act, 33 U.S.C. 1251 et seq.**

Sections 10, 401, and 404 permits may be required for some activities within wetlands and waterways. Although no structures are proposed in navigable waters of the United States, and no discharges of dredged or fill materials into waters or wetlands are proposed, permitting may be required in order to ensure that adequate sediment and erosion control plans are developed for site-specific prescriptions involving stream, wetland, or water source rehabilitation.

- **Clean Air Act, as amended, 42 U.S.C. 7609 et seq.**

Prescribed burning and other near term enhancement activities may produce smoke or expose mineral soils to wind action. This could result in temporary reductions in air quality at localized areas. It is anticipated, however, that such activities would not increase the degree of impact beyond those conditions resulting from spring and fall agricultural burning practices. Prescribed burns, vegetation management, and land contouring activities would be limited in size and conducted in accordance with Yakima Clean Air Authority and local Fire District permitting regulations. Project related traffic would not increase over existing conditions. No permanent emission sources would be constructed. The proposed action would not result in significant adverse effects on air quality.

- **Resource Conservation and Recovery Act, 42 U.S.C. 6910 et seq.**

This Act regulates the storage, use, and disposal of solid and hazardous waste. It is the policy of the Yakama Indian Nation, BPA, and BIA to perform an Environmental Land Audit (ELA) or equivalent examination prior to the purchase of any real property (e.g. fee title, and easements or leases as appropriate). The purpose of the ELA is to determine whether contaminants are located within the boundaries of the subject property or whether there is a risk of offsite contaminants migrating onto the subject property. To ensure that contaminant concerns have been addressed adequately, the highest level of ELA (Level I, II, III or combination) shall be conducted prior to the selection of individual sites for the Project. Project herbicide applications shall comply with the requirements of this Act.

- **Executive Order 11988, Floodplain Management and DOE Guidelines (10 CFR 1022)**

A Notice of Floodplain and Wetland Involvement for the Project was published in the Federal Register in May, 1994. Proposed habitat treatments would result in the long term protection of project area floodplains.

- **Farmland Protection Policy Act: 7 U.S.C. 4201 et seq.**

No adverse effects are expected to project area Unique or Prime Farmland designations because wildlife habitat enhancement and restoration activities are reversible land use conditions that do not preclude future farming practices if required.

- **Federal Insecticide, Fungicide, and Rodenticide Act: 7 U.S.C. 136 et seq.**

This Act regulates the manufacture and use of pesticides. Herbicides (a form of pesticide) would be used to control incompatible weedy vegetation within the project area. When applied only EPA approved herbicides would be used, and only according to manufacturers' labels. Herbicides would be employed by licensed applicators only on an as-needed basis and would not be stored on site.

5.2 Tribal Requirements Applicable to the Proposed Action

All activities would occur in compliance with requirements of the Yakama Indian Nation Land and Natural Resources Policy Plan. Hydrologic and ground water development would proceed in accordance with the Yakama Indian Nation Water and Hydraulic Codes. Activities which may affect natural resources would occur in compliance with the policies and programs of the Yakama Indian Nation Department of Natural Resources.

The Project would be conducted in consultation and coordination with the following Tribal agencies and departments:

Yakama Indian Nation, Department of Natural Resources
Yakama Indian Nation, Land Enterprises
Yakama Indian Nation, Environmental Protection
Yakama Indian Nation, Fisheries and Water Resources
Yakama Indian Nation, Water Code
Yakama Indian Nation, Cultural Resources

CHAPTER 6: CONSULTATION AND COORDINATION

6.1 Coordination

The Preliminary EA was sent to the State of Washington Department of Ecology Clearinghouse, the Yakima Indian Nation, and the interested public, for review and comment on June 15, 1994. The comment period closed on July 15, 1994. BPA received 2 comment letters. Comments were considered and incorporated, as appropriate, into the Final EA.

6.2 Agencies and Persons Contacted

The following individuals were contacted for information and comments regarding the Proposed Action:

Bonneville Power Administration	Joe DeHerrera, John Rowan, Robert Shank, Robert Walker
Yakama Indian Nation	Mike Bauer, William Bradley, Tracy Hames, Don Larsen, Rose Leach, Dave Lind, Gordon Lothson, Carroll Palmer
Bureau of Indian Affairs	Terry Berkompas, June Boynton, Rick Mains, Robert Palmer, Stanley Speaks
U.S.D.A. Soil Conservation Service	Edward Burton, Carl Hipple
U.S. Fish and Wildlife Service	Jodi Bush, Dave Frederick, Dawn Zebley
U.S. Army Corps of Engineers	Robert Martin
Washington Department of Ecology	Susan Billings
Washington Office of Archaeology and Historic Preservation	Robert Whitlam
Yakima Clean Air Authority	Chris Svenendsen
Yakima County Assessors Office	Curt Layman
Cover Design provided by	Becky Shank

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CHAPTER 8: LIST OF SPECIES CITED IN THE TEXT

Birds	
Great blue heron	*Ardea herodias*
Black-crowned night-heron	*Nycticorax nycticorax*
American bittern	*Botaurus lentiginosus*
Sandhill crane	*Grus canadensis*
Trumpeter swan	*Cygnus buccinator*
Canada goose	*Branta canadensis*
Mallard	*Anas platyrhynchos*
Gadwall	*A. strepera*
Blue-winged teal	*A. discors*
Cinnamon teal	*A. cyanoptera*
Northern shoveler	*A. clypeata*
Wood duck	*Aix sponsa*
Redhead duck	*Aythya americana*
Red-tailed hawk	*Buteo jamaicensis*
Swainson's hawk	*B. swainsoni*
Bald eagle	*Haliaeetus leucocephalus*
Northern harrier	*Circus cyaneus*
Osprey	*Pandion haliaetus*
Prairie falcon	*Falco mexicanus*
Peregrine falcon	*F. peregrinus*
American kestral	*F. sparverius*
California quail	*Lophortyx californicus*
Chukar	*Alectoris chukar*
Ring-necked pheasant	*Phasianus colchicus*
Long-billed curlew	*Numenius americanus*
Spotted sandpiper	*Actitis macularia*
Mourning dove	*Zenaida macroura*
Short-eared owl	*Asio flammeus*
Woodpeckers	Family Picidae
Lewis' woodpecker	*Melanerpes lewis*
Black-capped chickadee	*Parus atricapillus*
Warblers	*Dendroica* spp.
Yellow warbler	*D. petechia*
Western meadowlark	*Sturnella neglecta*

Mammals	
Beaver	*Castor canadensis*
Coyote	*Canis latrans*
Black bear	*Ursus americanus*
Mink	*Mustela vison*
Muskrat	*Ondontra zibethicus*
River otter	*Lutra canadensis*
Mule deer	*Odocoileus hemionus*

Fish

Brook trout	*Salvelinus fontinalis*
Chinook salmon	*Oncorhyncus tshawytscha*
Coho salmon	*O. kisutch*
Common carp	*Cyperinus carpio*
Cutthroat trout	*O. clarki*
Largemouth bass	*Micropterus dolomieui*
Minnow	Family Cyprinidae
Rainbow/steelhead trout	*O. mykiss*
Sculpins	Family Cottidae
Sucker	Family Catostomidae
Sunfish	Family Centrarchidae

Plants

Arrowhead	*Sagittaria latifolia*
Big sagebrush	*Artemisia tridentata*
Black cottonwood	*Populus trichocarpa*
Bladderwort	*Utricularia* sp.
Bluebunch wheatgrass	*Agropyron spicatum*
Bulrush	*Scirpus acutus*
Burreed	*Sparganium* spp.
Cattail	*Typha latifolia*
Chokecherry	*Prunus virginiana*
Coontail	*Ceratophylum demersum*
Cottonwood	*Populus* spp.
Giant wild rye	*Elymus condensatus*
Grasses	Family Poacea
Greasewood	*Sarcobatus vermiculatus*
Hawthorn	*Crataegus* sp.
Hopsage	*Grayia* sp.
Knapweed	*Centaurea* spp.
Pondweed	*Potamogeton* spp.
Rabbitbrush	*Chrysothamnus* sp.
Sagebrush	*Artemesia* spp.
Sago pondweed	*Potamogeton pectinatus*
Salt grass	*Distichlis spicata*
Sedges	*Carex* spp.
Sumac	*Rhus glabra*
Thistles	*Cirsium* spp.
Water lily	*Nuphar polysepalum*
Wild iris	*Iris missouriensis*
Wild rose	*Rosa woodsii*
Willow	*Salix* spp.

Appendix A. Sensitive species of amphibians, reptiles, birds, and mammals potentially found on the project area. Legal status of these species under Federal and state laws is included for reference. List is from Leach et al. (1992).

SPECIES	DESIGNATION: WASHINGTON	FEDERAL
AMPHIBIANS		
Tiger Salamander	SM	
Woodhouse's Toad	SM	
Spotted Frog	SC	FC
REPTILES		
Sharptail Snake	SM	
Ringneck Snake	SM	
Night Snake	SM	
Striped Whipsnake	SC	
BIRDS		
Common Loon	SC	
Red-necked Grebe	SM	
Western Grebe	SM	
American White Pelican	SE	
Great Blue Heron	SM	
Great Egret	SM	
Black-crowned Night-Heron	SM	
Turkey Vulture	SM	
Osprey	SM	
Bald Eagle	ST	FT
Sharp-shinned Hawk		
Cooper's Hawk		
Northern Goshawk	SC	FC
Swainson's Hawk	SC	
Ferruginous Hawk	ST	FC
Golden Eagle	SC	
Merlin	SM	
Prairie Falcon	SM	
Sage Grouse	SC	FC
Sharp-tailed Grouse	SC	FC
Wild Turkey		
Sandhill Crane	SE	
Black-necked Stilt	SM	

Appendix A (Cont.)

Long-billed Curlew	SM	
Caspian Tern	SM	
Forster's Tern	SM	
Black Tern	SM	FC
Snowy Owl	SM	
Burrowing Owl	SC	
Black Swift	SM	
Vaux's Swift	SC	
Lewis's Woodpecker	SC	
Pileated Woodpecker	SC	
Gray Flycatcher	SM	
Ash-throated Flycatcher	SM	
Purple Martin	SC	
Western Bluebird	SC	
Sage Thrasher	SC	
Loggerhead Shrike	SC	FC
Sage Sparrow	SC	
Grasshopper Sparrow	SM	

MAMMALS

Merriam's Shrew	SC	
Preble's Shrew	SM	FC
Pallid Bat	SM	
Northern Grasshopper Mouse	SM	
Sagebrush Vole	SM	

SE = State Endangered; ST = State Threatened; SC = State Candidate endangered, threatened, or sensitive; SM = State Monitor; SP = State Petitioned; FE = Federal Endangered; FT = Federal Threatened; FC = Federal Candidate.

Washington State designations based on WDW Publication "Species of Concern in Washington" dated 6/19/91. Federal designations based on USFWS "Federally listed Endangered, Threatened, and candidate species in Washington state (Revised January 1992)."

Appendix B. Selected portions of The Yakima Indian Nation Wildlife Mitigation Plan (Bich et al. 1991) concerning the Habitat Evaluations Procedures used in the loss assessments.

METHODS

Habitat Evaluation Procedures.

The Habitat Evaluation Procedures (HEP) (USFWS 1980) was used to assess wildlife losses associated with Lower Columbia River hydropower dams (Rasmussen and Wright 1990 a,b,c,d). We also used HEP to assess potential gains associated with our wildlife mitigation plan, facilitating direct comparisons of proposed mitigation gains relative to established loss estimates. This strategy ensured an adequate means of assessing the efficacy of the YIN mitigation proposal.

HEP utilizes Habitat Units (HUs) as the currency for addressing ecological losses or gains associated with any project development and implementation. HUs for a given species are the product of habitat quantity (acres) and habitat quality estimates. Habitat quality estimates are provided by a Habitat Suitability Index (HSI). HSI values range from 0.0 to 1.0 and are a projection of a given habitat parcel's ability to provide the life requisites of a given species. An HSI = 1.0 indicates essentially optimum habitat conditions for the species in question. HSI values for a given species are determined on the basis of quantifiable habitat features (e.g., vegetation height, tree canopy cover, distance to water) which are known to be required for the success of that species. These HSI relationships are usually found in published HEP models.

Species/Cover Type Selection Rationale.

Ten evaluation species were used in the HEP of the mitigation study area. These ten species were the same evaluation species used in the Lower Columbia and Bonneville impact assessments, thus ensuring in-kind mitigation. This strategy was required to judge the effectiveness of the proposed mitigation project as direct compensation for losses associated with Lower Columbia River hydropower development.

It was recognized that evaluation species selected for the Lower Columbia and Bonneville Dams impact assessments were chosen according to one of two primary criteria. Species such as the Canada goose and the mallard were selected due to their regional importance, whereas species such as the yellow warbler, black-capped chickadee, and downy woodpecker were chosen as guild representatives or "indicator species". Indicator species are not necessarily of regional or national significance, but are chosen as a representative of a particular environment or set of habitat conditions. It is assumed that by measuring impacts and/or benefits to these indicator species, impacts and/or benefits to a host of other species with similar environmental requirements are also addressed.

Assessment of Mitigation Plan Benefits

Cover Type Mapping.

We determined the area of major cover types using a high-density dot grid overlaid on 1:24,000 aerial photographs of the mitigation study area. With the exception of the island cover type, our cover types were the same as those used in the Lower Columbia and Bonneville Dams impact assessments (Appendix C). The major loss associated with inundation of main-stem Columbia River islands was Canada goose nesting habitat. Because the nesting behavior of Canada geese in the YIN mitigation study area differs from that in the Lower Columbia River, island cover types do not truly represent nesting Canada goose Habitat Units. Therefore, we did not determine acreage of islands within the Yakima River corridor; mitigation project benefits to nesting geese were addressed primarily in riparian forest cover types.

Sampling Design.

As with the Lower Columbia and Bonneville Dams impact assessments, we determined HUs for evaluation species in 1-6 cover types, depending on model specifications (Table 5). Six sample sites were visited for each cover type analyzed. Within each cover type the number of evaluation species varied according to the sampling design of the Lower Columbia and Bonneville Dams impact assessments. HUs were determined for each evaluation species/cover type on the basis of six samples. Therefore, the total number of samples used to determine potential HU gains for each evaluation species was 6(n), where n = the number of cover types in which the evaluation species model was applied. Sample sites for each cover type were chosen from aerial photographs on the basis of being locally representative of the cover type.

Table 5. Cover types/species used in
HEP analysis for YIN wildlife mitigation plan.

Species	Riparian Forest	Riparian Shrub	Riparian Herb	Riverine	Lacus-trine	Sand,Grv, Cob,Mud	Emergent Wetland	Shrub-steppe/ Grassland	Agricul tural
California Quail		X	X				X	X	
Canada Goose			X		X	X		X	
Mallard			X	X	X		X	X	X
Sp. Sandpiper						X			
Mink	X	X		X		X	X		
W. Meadowlark								X	
Chickadee	X								
Yellow Warbler		X							
Woodpecker	X								
Great Blue Heron	X			X	X	X		X	

HEP Modifications.

An inter-agency team was assembled on July 9-13, 1990 to conduct the HEP field work. Aerial photograph estimates of certain HSIs were completed the following week. The application of the HEP was modified to allow a team-based estimation approach. Under this approach, an inter-agency HEP team visited each sample site; species models were discussed by the team; and a consensus was achieved for each variable (e.g., average height of shrubs). Certain variables were estimated from aerial photographs or by subjective judgment (Appendix C).

Habitat suitability curves found in published species' models are typically continuous functions. For example, as shrub height increases continuously, so would the corresponding habitat suitability value. Because it was unrealistic to assume we could achieve the resolution in estimating variable values needed to support a continuous function without actually measuring habitat features, the suitability curves were modified (Appendix C). Ranges (e.g., <1 m, 1-2 m, >2 m for shrub height) were constructed for each variable and midpoint suitability index (SI) values for each range were determined from the original continuous functions. The published HSI equations (the equation that combines all variables' SIs to produce an overall HSI) were used for each species. The only species model we conceptually modified was the Canada goose model. This modification reflected the local tree-nesting behavior of Canada geese in the Yakima River corridor (Appendix C). We believe this allows a more accurate assessment of the proposed mitigation project's benefits to nesting Canada geese within the YIN mitigation study area.

Mitigation Crediting.

When crediting HUs as wildlife mitigation, we matched HUs of benefit for a given species with HUs of loss for only the same species. For example, lost spotted sandpiper HUs will be compensated only with gains of spotted sandpiper HUs, not gains of another species' HUs. This ensures in-kind compensation.

Because the HUs of loss or benefit were not annualized (USFWS 1980), the mitigation crediting process is simplified. This simplification, however, allowed a less accurate assessment of the losses on the Lower Columbia and Bonneville Projects. The resultant losses were underestimated because the simplified process assumes that all wildlife habitat damage took place at one time, i.e., at the flooding of the reservoirs. By assuming that all of the wildlife benefits will be gained when the mitigation plan is started, benefits due to habitat establishment and other long-term impact projects will be over-estimated. This method results in a conservative mitigation effort as it is assumed that the mitigation efforts will continue throughout the life span of the four dams.

Further, we differentiated between the benefits from protection and those from enhancement of a land parcel. This is because some of the mitigation area lands may need to be purchased to ensure wildlife habitat protection from harmful land-uses. Other lands are already controlled by YIN and thus may be enhanced for wildlife habitat without ownership change. For each species/cover type we calculated HUs of protection (baseline HSI X number of purchasable acres) and HUs of enhancement ([predicted enhanced HSI - baseline HSI] X number of enhanceable acres). To meet the constraints involved when not all of the landowners are willing to sell their lands, and when not all of the YIN-controlled lands can be effectively managed for wildlife, the percentage of purchasable and enhanceable land was determined. Based on records of land ownership and local land sales, it was estimated that 18% of study area lands are

purchasable and 35% are enhanceable for wildlife. Total potential mitigation HUs, then, are the sum of the baseline HUs of lands which will need protection by purchase and the total HUs of benefit from the enhancement lands. This approach is similar in some respects to that used in the Dworshak mitigation plan (Meuleman et al. 1989).

RESULTS AND DISCUSSION

HEP Results.

The YIN baseline HEP for the 50,308-acre mitigation study area resulted in 85,993 HUs for all 10 species combined (Table 6). Because all land within the study area is not available for sale or enhancement, our mitigation crediting (18% purchasable, 35% enhanceable) resulted in 25,514 HUs (9,986 HUs of protection, 15,528 HUs of enhancement) on 26,663 acres for the same 10 species (Table 7,8). This represents 34% of the total wildlife HU losses in the Lower Columbia and Bonneville Dams impact assessments (Table 9). These proposed gains vary by species from less than 1% of spotted sandpiper HU losses to 89% of downy woodpecker HU losses (Table 9).

The percentage of land available for purchase (18%) was estimated using records of land ownership and sales in the project area. Presently, 69% of the land within the project area is non-Tribal controlled (Table 4). All land purchases will be on a willing-seller basis only. It will not be desirable to purchase all of the land available in the project area because such a policy could greatly inflate land values. By purchasing only 18% of the project lands, the mitigation goals can be met in a cost-effective manner.

The percentage of land available for enhancement (35%) was derived using similar records. Current land-use practices mandate that some of the lands will not need enhancement and that on others wildlife enhancement will not be possible due to conflicting land-use practices. Because of this, enhancement will also occur on a proportion of the purchased land. We feel that this estimate of the amount of enhanceable land is conservative, but allows for flexibility in operation, depending on which land areas are purchasable.

HEP Discussion.

Because of the scope of the mitigation project, certain modifications to the HEP were required (see Methods section). Cover type acreages were estimated in proportion to their occurrence on a stratified random selection of aerial photographs. The land areas deemed purchasable and enhanceable, then, may not completely reflect the same proportions of cover types. This will require minor adjustments in this generic plan as it is implemented.

Another modification of the HEP occurred in the estimation of the HSIs at field locations. Time constraints, the large size of the project area and the number of cover types and species analyzed required visual estimation of the variables used in the HSI estimate. We felt that, by estimating the variables and not the HSIs at the sites, accuracy would be maintained because

discussion among the HEP team members would be restricted to measurable units such as grass height instead of abstract concepts such as HSI. This produced HSI estimates with the amount of accuracy desired and also allowed for time constraints placed on the survey due to the many volunteer cooperators. Had actual measurements been made of the variables, the HEP would have required several weeks and probably resulted in little gain in accuracy.

For mitigation crediting proposed gains for land acquisitions were given the full baseline HU values. We realize that acquiring lands or conservation easements does not inherently create new habitat or result in any net gain to offset project-related losses. Thus, our mitigation proposal presents a conservative mitigation effort. However, some lands in our mitigation study area are currently under threat of development. These lands require acquisition to preserve their wildlife habitat value. We feel that this may be necessary in order to expedite the mitigation process and successfully offset wildlife losses identified for the Lower Columbia and Bonneville Dams.

Table 6. YIN baseline HEP results for wildlife mitigation plan for Lower Columbia River, 1990. The upper figure under each species heading is the HSI, the lower figure is habitat units.

Cover/ Acres	Calif. Quail	Canada Goose	Mallard	Spotted Sandpiper	Mink	Western Meadowlark	Black-capped Chickadee	Yellow Warbler	Great blue Heron	Downy Woodpecker
Rip. Shrub	.8 2,477				.8 2,477			.8 2,477		
Agric. 14,963	.6 8,978		.2 2,993							
Rip. For. 2,064		1.0 2,064			1.0 1,858		.9 1,858		.9	.9 1,858
Rip. Herb 3,096	.8 2,477	.5 1,548	.5 1,548							
SGCM 256		.9 232		1.0 258	.8 206					
Lacust. 516		.7 361	.6 310		.7 361				1.0 516	
River. 1,032			.6 619						1.0 1,032	
Em. Wet. 1,584			.7 1,084		.8 1,238					
SS/Gr 23,735	.5 11,868	.5 11,868	.3 7,121			.5 11,868			.1 2,374	
Total HU	25,800	15,856	13,669	258	6,339	11,868	1,858	2,477	5,780	1,858

Grand Total HU= 85,993

Table 7. YIN HEP results for wildlife mitigation plan for Lower Columbia River, 1990. The upper figure under each species heading is the baseline HSI, the second figure is habitat units of protection, the third figure is a prediction of HSI after enhancement, the fourth figure is habitat units of enhancement [(enhancement HSI - baseline HSI) X acres].

Cover Acres	Quail	Goose	Mallard	Sandpiper	Mink	Meadowlark	Chickadee	Warbler	Heron
Rip.									
Shrub	.8				.8			.8	
557	446				446			446	
1,084	.8				.8			.8	
	0							0	
Agric.	.6		.2						
2,693	1,616		539						
5,237	.7		.5						
	524		1,571						
Rip.									
For/		1.0			1.0		.9		.9
372		372			372		335		335
722		1.0			1.0		.9		.9
		0			0		0		0
Rip.									
Herb	.8	.5	.5						
557	446	279	279						
5,084	.9	.9	.8						
	108	434	325						
SGCM		.9		1.0	.8				1.0
46		42		46	37				46
90		.9		1.0	.8				1.0
		0		0	0				0
Lacust.		.7	.6		.7				1.0
93		65	56		65				93
181		1.0	.9		.7				1.0
		54	54		0				0
River.			.6						1.0
186			111						186
361			.9						1.0
			108						0
Em. Wet			.7		.8				
279			195		223				
542			1.0		.8				
			163		0				
SS/Gr	.5	.5	.3			.5			.1
4,272	2,136	2,136	1,282			2,136			427
8,307	.6	.7	.5			.7			.2
	831	1,661	1,661			1,661			832
Total Pro. Hus	4,644	2,894	2,462	46	1,143	2,135	336	446	1,087
Total En. Hus	1,463	2,149	3,882	0	0	1,661	0	0	831
Tot. Hus	6,107	5,043	6.344	46	1,143	3,797	335	446	1,918

Grand Total Hus = 25,514 Total Acres = 26,663
Grand Total HU = 25,514

first figure is acres/cover type in project area X 18% estimated purchasable acres for protection; second figure is acres/cover type in project area X 35% estimated enhanceable acres (see p. for explanation).

Table 8. Proposed HUs of benefit/species for the YIN wildlife mitigation plan.

Species	Enhancement HUs	Protection HUs	Total HUs
California quail	1,463	4,644	6,107
Canada goose	2,149	2,894	5,043
Mallard	3,882	2,462	6,344
Spotted sandpiper	0	46	46
Mink	0	1,143	1,143
Western meadowlark	1,661	2,136	3,797
Black-capped chickadee	0	335	335
Yellow warbler	0	446	446
Great blue heron	831	1,087	1,918
Downy woodpecker	0	335	335
Total	9,986	15,528	25,514

Table 9. Wildlife HU losses/species on Lower Columbia and Bonneville Dams (Rasmussen and Wright 1990 a,b,c,d) and proposed HU ga

Species	Losses	Proposed Gains	% Compensation
California quail	12,638	6,107	48%
Canada goose	14,376	5,043	35%
Mallard	14,358	6,344	44%
Spotted sandpiper	7,850	46	<1%
Mink	4,639	1,143	25%
Meadowlark	8,775	3,797	43%
Black-capped chickadee	2,074	335	16%
Yellow warbler	1,747	446	26%
Great blue heron	7,913	1,918	24%
Downy woodpecker	377	335	89%
Total	74,747	25,514	34%

APPENDIX C. GLOSSARY OF TERMS

Agricultural Cover Type

Characterized by crops such as corn, wheat, alfalfa and mint, agricultural croplands are modified seasonally by intensive agricultural practices such as cultivation and irrigation. The agricultural cover type experiences large seasonal variation in vegetation structure and habitat quality. Cover and forage habitat values can vary from high to low in one growing season, as fields are planted, harvested, and rotated.

Alluvial Deposition

Sediment deposited by flowing water, as in a river bed.

Backwater

A place characterized by non-flowing water. See Lacustrine.

Dike

A ditch or channel with an embankment, such as a levee.

Emergent Wetland Vegetation

Plants that grow in shallow water with the root system submerged and the upper vegetation rising above the water.

Eutrophication

Change brought about by the addition of excessive plant nutrients to a lake, stream, or other body of water. The nutrients in excess are usually nitrates or phosphates which results in prolific growth of aquatic plants. Eutrophication is considered undesirable because of reduced aesthetic values, changes in fish populations from more desirable to less desirable species, and aquatic vegetation control problems.

Floodplain

The area bordering a river, subject to flooding.

Habitat

The area or type of environment in which a plant or animal normally lives or occurs.

Habitat unit

Habitat Evaluation Procedure (HEP) analysis was used to determine base line habitat conditions and to estimate existing habitat units in the project area. One habitat unit is equivalent to one acre of optimum habitat for a given indicator species.

Hemi-marsh

An area of low-lying wetland; a swamp.

Hydric soil

Soil containing an abundance of water or wet soils.

Hydrograph

A graph of a stream or river discharge at a certain point over a period of time.

Intrinsic Habitat Value

Pertaining to the essential nature or desirable value of wildlife habitat. Wildlife habitat as desired for its own sake without regard to anything else.

Invertebrates

A primary division of the animal kingdom made up of organisms having no backbone or spinal column such as zooplankton, insects, insect larvae.

Lacustrine

Pertaining to lakes as in lacustrine environment. If no water flow is evident, i.e. in lakes or ponds, an ecosystem is considered lacustrine. The lacustrine cover type is characterized not by the presence of the plant community but rather the presence of the body of water.

Land Acquisition

Securing from willing landholders on the Yakama Indian Reservation fee patent lands, trust lands, or individual allotments and their associated water rights by purchase, lease, or conservation easement for the Lower Yakima Valley Wetlands and Riparian Restoration Project.

Land Contouring

Approximate 1-3 foot cuts and earthberms intended to hold water in sites ranging from 100 acres to an acre in size. Land contours would be developed only to the extent necessary to restore the land to a condition similar to natural wetlands or river channel characteristics.

Macroinvertebrates

Aquatic invertebrates such as fresh water shrimp, aquatic insects, or crayfish. See invertebrates.

Macrophytes

Aquatic vegetation or plant species.

Native vegetation

Plants originating or occurring naturally in an area.

Oxbow

A U-shaped bend or meander in a river.

Oxbow Lake

A crescent shaped lake formed in the abandoned channel of a meander by the silting up of its ends. Commonly occurs after the stream has cut through a meander at its narrowest point and in the process of forming a new stream channel.

PM-10

Particulate matter in air less than 10 microns in diameter. Common in smoke and dust emissions.

Rainshadow

A region of reduced rainfall to the east or lee of high mountains.

Riparian Vegetation

Vegetation located along the banks of a stream, pond, or lake that serves as a narrow edge community between aquatic and upland plant communities. Provides valuable cover foraging and nesting habitat for a variety of species from passerine birds to large mammals.

Riverine

If water is flowing, i.e., in streams, rivers, irrigation canals, or irrigation drains, the system is classified as riverine. The riverine cover type is characterized not by the presence of specific plant community but rather the presence of the body of water.

Sand/gravel/cobble/mud Cover Type

Occurs adjacent to streams or ponds and lakes, and is characterized by a sparsely vegetated beach appearance. These sites are most often used for shorebird foraging and nesting, and waterfowl loafing. This cover type occurs mostly along the Yakima river and to a limited extent along Toppenish Creek.

Seral

One of a series of stages that follow each other in an ecological succession prior to the climax stage.

Shrub-Steppe Vegetation

In the project area this upland vegetative cover type is an aggregate of native and pasture land plant communities. These upland locations are identified by native big sagebrush/bluebunch wheatgrass associations, and as idle croplands or livestock grazing pastures.

Slough

A river side channel characterized by sluggish or non flowing water. See Lacustrine.